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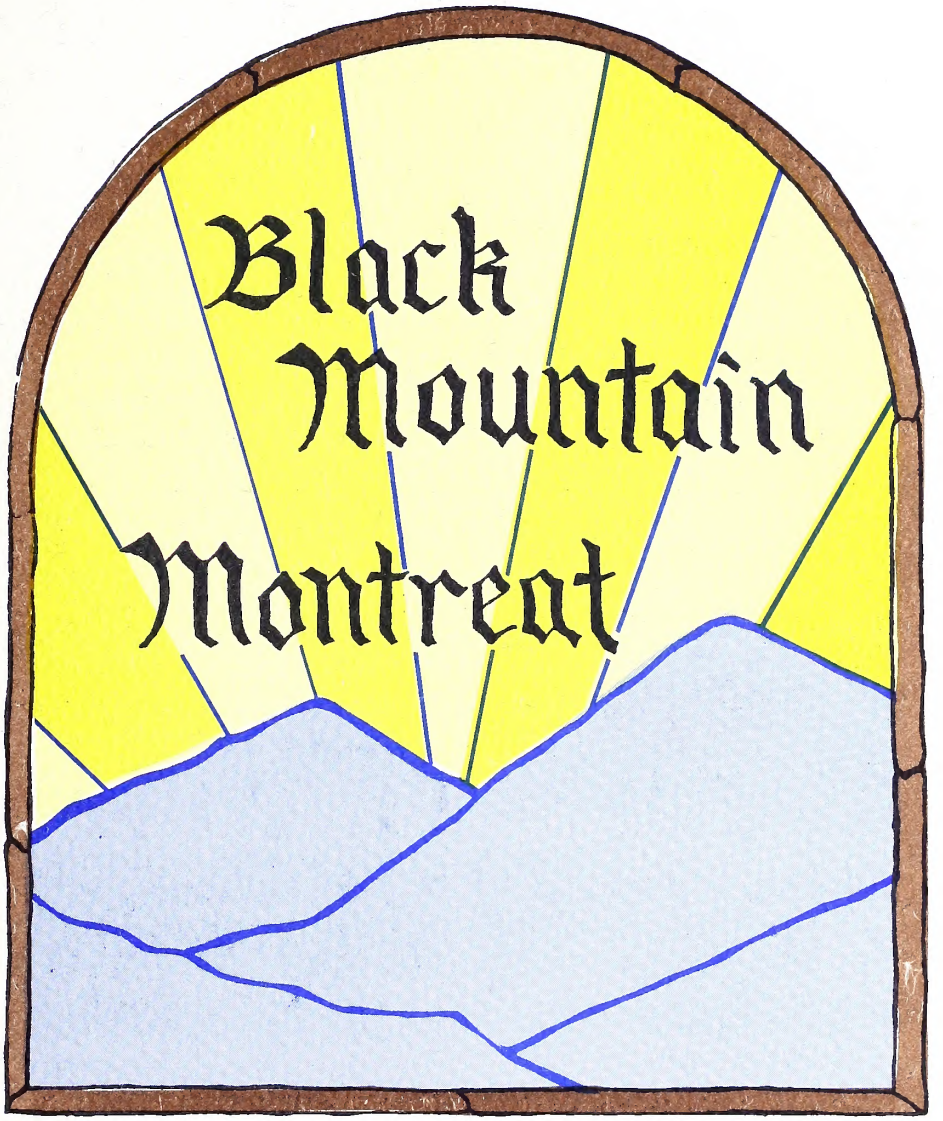
STATEWIDE PLANNING BRANCH



Thoroughfare Plan

MARCH 1992

Black Mountain-Montreat

Thoroughfare Plan

April 15, 1992

Prepared by the:

Thoroughfare Planning Unit
Statewide Planning Branch
Division of Highways
North Carolina Department of Transportation

Blake Norwood

A. B. Norwood, Jr.

In cooperation with:

The Towns of Black Mountain and Montreat
The Asheville Urban Area
The Federal Highway Administration
U.S. Department of Transportation

Persons responsible for this report:

Statewide Planning Branch Manager	M. R. Poole, Ph.D., P.E.
Thoroughfare Planning Engineer:	A. B. Norwood, Jr., P.E.
Project Engineer:	S. A. Klemm
Project Engineer:	C. A. Satterwhite
Project Technician:	J. M. Neely
Drafting Technician:	T. E. Adams

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I. INTRODUCTION

The Towns of Black Mountain and Montreat are nestled in the North Carolina mountains approximately 13 miles east of Asheville along the eastern edge of Buncombe County. Montreat is located immediately north of Black Mountain, sharing town limits with its southern neighbor. According to 1990 census figures, the combined population of the two towns is 6,111. Montreat's permanent population is approximately 1/7 that of Black Mountain; however, as a religious retreat, it draws numerous visitors to its busy conference center, vacation homes and camps. During peak season, Montreat's population can increase almost ten times normal. Black Mountain, itself, draws large numbers of visitors due to its picturesque location and the various religious centers and camps nearby. The Black Mountain Folk Music Festival draws tourists in early fall. Both towns are primarily residential. Black Mountain supplies the towns with a central business district and commercial activity as Montreat has none. The two towns can be reached via I-40 or US 70. Montreat is only accessible through the "Gates of Montreat", a stone archway on NC 9.

Black Mountain and Montreat became part of the Asheville Urban Area as a result of the 1980 U.S. Census. The Asheville Urban Area includes Asheville, Biltmore Forest, Black Mountain, Fletcher, Montreat, Weaverville, and Woodfin and adjoining urban portions of Buncombe County. Federal guidelines require that all urban areas with a population of over 50,000 people have a thoroughfare plan. Additionally, North Carolina General Statute 136-66.2 requires all municipalities to devise a major street plan in cooperation with the North Carolina Department of Transportation (NCDOT). As part of the urban area updating its existing thoroughfare plan, a new plan for Black Mountain and Montreat has been developed. This new plan will replace the existing thoroughfare plan dated 1981. The Black Mountain-Montreat Thoroughfare Plan was developed separately from the Asheville Thoroughfare Plan. The transportation system of the rest of the urban area (excluding Weaverville) operates as a unit and is being computer modeled as a whole. Since Black Mountain, Montreat, and Weaverville operate somewhat independently of the rest of the urban area, the computer model would not accurately predict traffic volumes for these towns. Consequently, the Weaverville and Black Mountain-Montreat plans have been developed separately from the rest of the urban area. Although separate, these plans are coordinated with the Asheville plan because the municipalities share some of the same roads and traffic.

The purpose of this report is to document the findings and recommendations of a thoroughfare study conducted by the North Carolina Department of Transportation. Included in this report are recommendations for thoroughfare cross

sections, cost estimates for proposed improvements, an evaluation of the benefits to be gained from improvements, and recommendations for plan implementation.

Thoroughfare planning provides many benefits, but the primary objective is to guide the development of the street system in a manner that will adequately serve the future traffic demand. The thoroughfare plan is based on accepted thoroughfare planning principles.

It should be emphasized that the recommended plan is based on anticipated growth of the urban area as indicated by current trends. Prior to construction of specific projects, a more detailed study will be required to reconsider development trends and to determine specific locations, design requirements, and more detailed environmental concerns. Also, should development occur differently from what has been projected, the Towns may request that the thoroughfare plan be revised to reflect those changes.

II. THOROUGHFARE PLANNING PRINCIPLES

Objectives

Typically, the urban street system occupies 25 to 30 percent of the total developed land in an urban area. Since the system is permanent and expensive to build and maintain, much care and foresight is needed in its development. Thoroughfare planning is the process public officials use to assure the development of the most appropriate street system that will meet existing and future travel desires within the urban area.

The primary aim of a thoroughfare plan is to guide the development of the urban street system in a manner consistent with changing traffic demands. Through proper planning for street development, many costly errors and much needless expense can be averted. A thoroughfare plan will enable street improvements to be made as traffic demands increase, and help eliminate unnecessary improvements. By developing the urban street system to keep pace with increasing traffic demands, a maximum utilization of the system can be obtained that will require a minimum amount of land for street purposes. In addition to providing for traffic needs, the thoroughfare plan should embody those details of good urban planning necessary to present a pleasing and efficient urban community. The location of present and future population and commercial and industrial enterprises affects major street and highway location. Conversely, the location of major streets and highways within the urban area will influence the urban development pattern.

Other objectives of a thoroughfare plan include:

1. Providing for the orderly development of an adequate major street system as land development occurs;

2. Reducing travel and transportation costs;

3. Reducing the cost of major street improvements to the public through the coordination of the street system with private action;

4. Enabling private interest to plan their actions, improvements, and development with full knowledge of public intent;

5. Minimizing disruption and displacement of people and businesses through long range advance planning for major street improvements;

6. Reducing environmental impacts such as air pollution, resulting from transportation;

7. Increasing travel safety.

Thoroughfare planning objectives are achieved through both: (1) improving the operational efficiency of thoroughfares; and (2) improving the system efficiency through system coordination and layout.

Operational Efficiency

A street's operational efficiency is improved by increasing the capability of the street to carry vehicular traffic and people. In terms of vehicular traffic, a street's capacity is defined as the maximum number of vehicles which can pass a given point of a roadway during a given time period under prevailing roadway and traffic conditions. Capacity is affected by the physical features of the roadway, nature of traffic, and weather.

Physical ways to improve vehicular capacity include street widening, intersection improvements, improving vertical and horizontal alignment, and eliminating roadside obstacles. For example, widening of a street from two to four travel lanes more than doubles the capacity of the street by providing additional maneuverability for traffic. Impedances to traffic flow caused by slow moving or turning vehicles and adverse effects of horizontal and vertical alignments are thus reduced.

Operational ways to improve street capacity include:

1. Control of access - A roadway with complete access control can often carry three times the traffic handled by a non-controlled access street with identical lane width and number.

2. Parking removal - Increases capacity by providing additional street width for traffic flow and reducing friction to flow caused by parking and unparking vehicles.

3. One-way operation - The capacity of a street can sometimes be increased 20-50%, depending upon turning movements and overall street width, by initiating one-way traffic operations. One-way streets can also improve traffic flow by decreasing potential traffic conflicts and simplifying traffic signal coordination.

4. Reversible lanes - Reversible traffic lanes may be used to increase street capacity in situations where heavy directional flows occur during peak periods.

5. Signal phasing and coordination - Uncoordinated signals and poor signal phasing restrict traffic flow

by creating excessive stop-and-go operation.

Altering travel demand is a third way to improve the efficiency of existing streets. Travel demand can be reduced in the following ways:

1. Encourage people to form carpools and vanpools for journeys to work and for other trip purposes. This reduces the number of vehicles on the roadway and raises the people carrying capability of the street system.

2. Encourage the use of the transit, bicycle, and pedestrian modes.

3. Encourage industries, business, and institutions to stagger work hours or establish variable work hours for employees. This will reduce travel demand in peak periods and spread peak travel over a longer time period.

4. Plan and encourage land use development or redevelopment in a more travel efficient manner.

System Efficiency

Another means for altering travel demand is the development of a more efficient system of streets that will better serve travel desires. A more efficient system can reduce travel distances, time, and cost. Improvements in system efficiency can be achieved through the concept of functional classification of streets and development of a coordinated major street system.

Functional Classification

Streets perform two primary functions -- traffic service and land service, which when combined, are basically incompatible. The conflict is not serious if both traffic and land service demands are low. However, when traffic volumes are high, conflicts created by uncontrolled and intensely used abutting property lead to intolerable traffic flow, friction, and congestion.

The underlying concept of the thoroughfare plan is that it provides a functional system of streets which permits travel from origins to destinations with directness, ease, and safety. Different streets in the system are designed differently and are called on to perform specific functions, thus minimizing the traffic and land service conflict. Streets are categorized as to function as local access streets, minor thoroughfares, and major thoroughfares.

Local Access Streets provide access to abutting

property. They are not intended to carry heavy volumes of traffic and should be located such that only traffic with origins and destinations on the streets would be served. Local streets may be further classified as either residential, commercial, or industrial depending upon the type of land use which they serve.

Minor Thoroughfares are more important streets in the system. They collect traffic from local access streets and carry it to the major thoroughfares. They may in some instances supplement the major thoroughfare system by facilitating minor through traffic movements. A third function which may be performed is that of providing access to abutting property. They should be designed to serve limited areas so that their development as major thoroughfares will be prevented.

Major Thoroughfares are the primary traffic arterials Their function is to move traffic within and between cities. The streets that comprise the major thoroughfare system also may serve abutting property; however, their principal function is to carry traffic. They should not be bordered by uncontrolled strip development because such development significantly lowers the capacity of the thoroughfare to carry traffic and each driveway is a danger and an hindrance to traffic flow. Similarly, parking is normally not permitted on major thoroughfares. Major thoroughfares may range from a two-lane street carrying minor traffic volumes to major expressways with four or more traffic lanes. Expressways and freeways are further characterized by controlled access and higher speed limits. Their sole purpose is to carry traffic.

Idealized Major Thoroughfare System

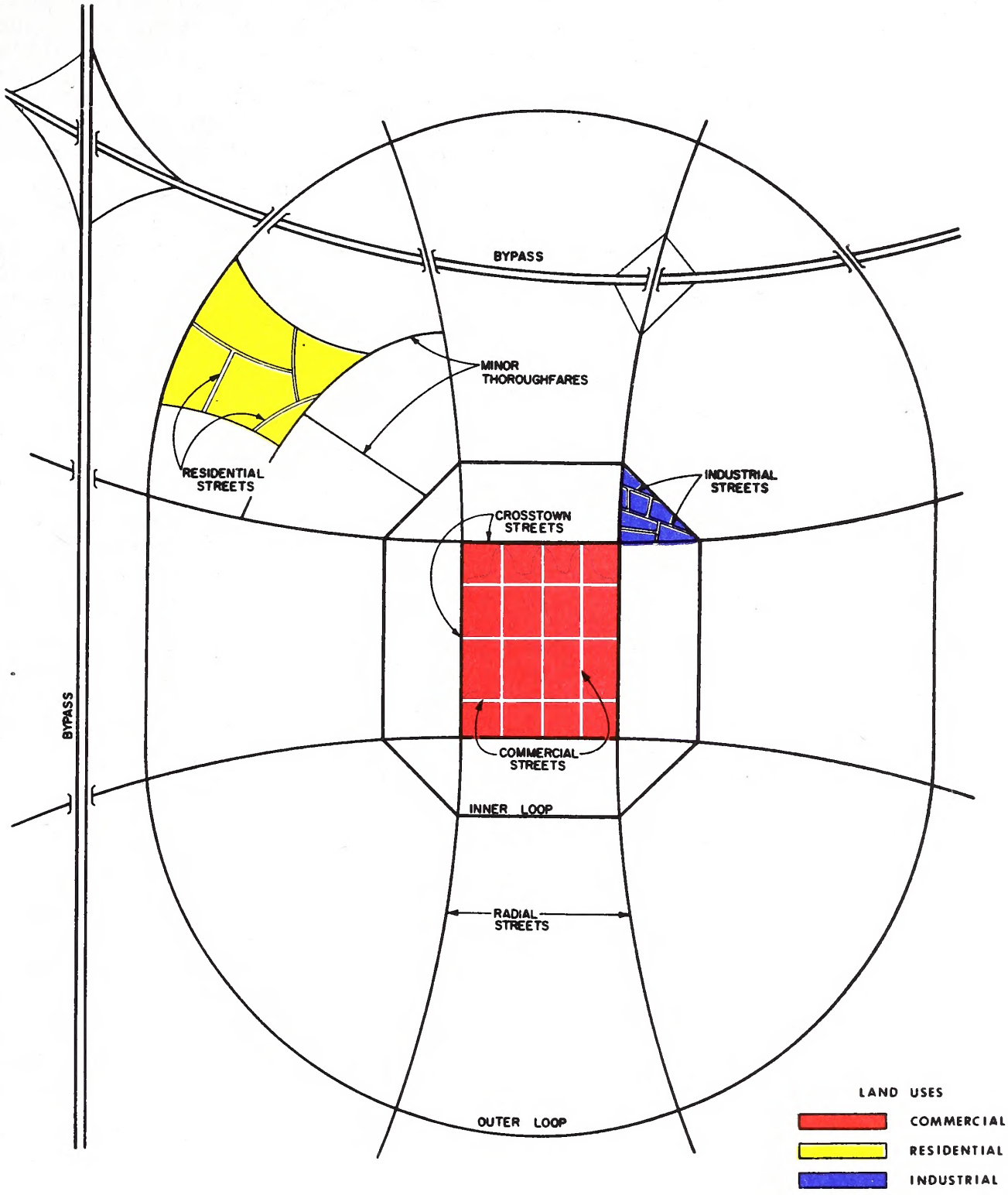
A coordinated system of major thoroughfares forms the basic framework of the urban street system. The ideal major thoroughfare system is the radial-loop system. Moreso than other street networks, it adapts to the desired lines of travel within an urban area and permits movement between various areas of the city with maximum directness. This system consists of several functional elements -- radial streets, crosstown streets, loop system streets, and bypasses. Figure 1 illustrates this idealized thoroughfare system.

Radial streets provide for traffic movement between points located in the outskirts of the city and the central area. This is a major traffic movement in most cities, and the economic strength of the central business district depends upon the adequacy of this type of thoroughfare.

If all radial streets crossed in the central area, an intolerable congestion problem would result. To avoid this

FIGURE 1

IDEALIZED THOROUGHFARE PLAN



problem, it is very important to have a system of crosstown streets that form a loop around the central business district. This system allows traffic originating on one side of the central area and destined on the other to travel around the area's border. It also allows central area traffic to circle and then enter the area near a given destination. A good crosstown system frees the central area of crosstown traffic, thus permitting the central area to function more adequately in its role as a business area or pedestrian shopping area.

Loop system streets move traffic between suburban areas of the city. Although a loop may completely encircle the city, a typical trip may be from an origin near a radial thoroughfare to a destination near another radial thoroughfare. Loop streets do not necessarily carry heavy volumes of traffic, but they help relieve traffic in central areas. There may be one or more loops, depending on the size of the urban area, and they are generally spaced one-half mile to one mile apart, depending on the intensity of land use.

A bypass is designed to carry traffic through or around the urban area, thus providing relief to the city street system by removing traffic which has no desire to be in the city. Bypasses are usually designed to through highway standards, with control of access. On occasions, a bypass with a low traffic volume can be designed to function as a portion of an urban loop. The general effect of bypasses is to expedite the movement of through traffic and to improve traffic conditions within the city. By freeing the local streets for use by shopping and home-to-work traffic, bypasses tend to increase the economic vitality of the local area.

Application of Thoroughfare Planning Principles

The concepts presented in the discussion of operational efficiency, system efficiency, idealized major thoroughfare system, and functional classification are conceptual tools available to the transportation planner in developing a thoroughfare plan. In actual practice, thoroughfare planning is done for established urban areas and is constrained by existing land use and street patterns, existing public attitudes and goals, environmental and social impacts of proposed improvements, and current expectations of future land use. Compromises must be made because of these and the many other factors that affect major street locations.

III. EXISTING AND PROJECTED CONDITIONS

Major Routes

Interstate 40 runs through the southern part of Black Mountain and serves much of the long distance east and west traffic. US 70 begins in Black Mountain and runs parallel to I-40 until it reaches Asheville. Because I-40 is controlled access and therefore has no turn-offs or signals, the majority of travelers going from Black Mountain or Montreat to Asheville or beyond choose to use I-40 instead of US 70. In addition to I-40 and US 70, Old US 70 (SR 2435) serves east-west traffic.

NC 9 is the major north-south road. The heart of the downtown business district is at the intersection of NC 9 and US 70. NC 9 also serves as the only entrance to the Town of Montreat. Tom Brown Road/North Fork Road and Blue Ridge Road/Cragmont Road also serve as major thoroughfares. The first loops cross northern and western Black Mountain through residential and rural land. The latter encircles southern and central Black Mountain. Most of the roads in Black Mountain and Montreat are rural or residential.

Population

Population influences the amount and type of traffic which a street system will experience and, therefore, is a factor in the determination of the transportation needs of an area. Examination of population and other contributing factors helps to establish and explain historic traffic patterns and project future patterns.

According to 1990 census figures, Black Mountain and Montreat have 5,418 and 693 residents, respectively, resulting in a combined population of 6,111 people. Between 1970 and 1990, the population of Black Mountain grew at a rate of approximately 2.7% per year. Black Mountain is growing faster than Buncombe County which has a growth rate of approximately 1.0%. Although since 1970 Montreat's population has increased almost at the rate of the county, the population decreased 0.6% between 1980 and 1990. Close to twenty properties are developed here every ten years, in effect, limiting growth to about 0.5% per year. This rate was used for projections. Montreat probably will continue to grow at a slower rate than the county or the North Carolina average. Two to four percent population growth is considered average for most North Carolina municipalities. Each of the above rates represents growth compounded yearly.

The following table lists population figures obtained from the Bureau of Census. Excluding Montreat, future population figures were estimated by applying growth rates based on historical population trends to 1990 populations.

Table 1. Population Growth /1

YEAR	MONTREAT	BLACK MOUNTAIN	BUNCOMBE COUNTY
1970	---	3,204	145,056
1980	---	4,083	160,934
1990	693	5,418	175,493
2020/2	813	11,106	216,704

/1 Source: U.S. Bureau of Census
/2 Based on historical growth rates, excluding Montreat

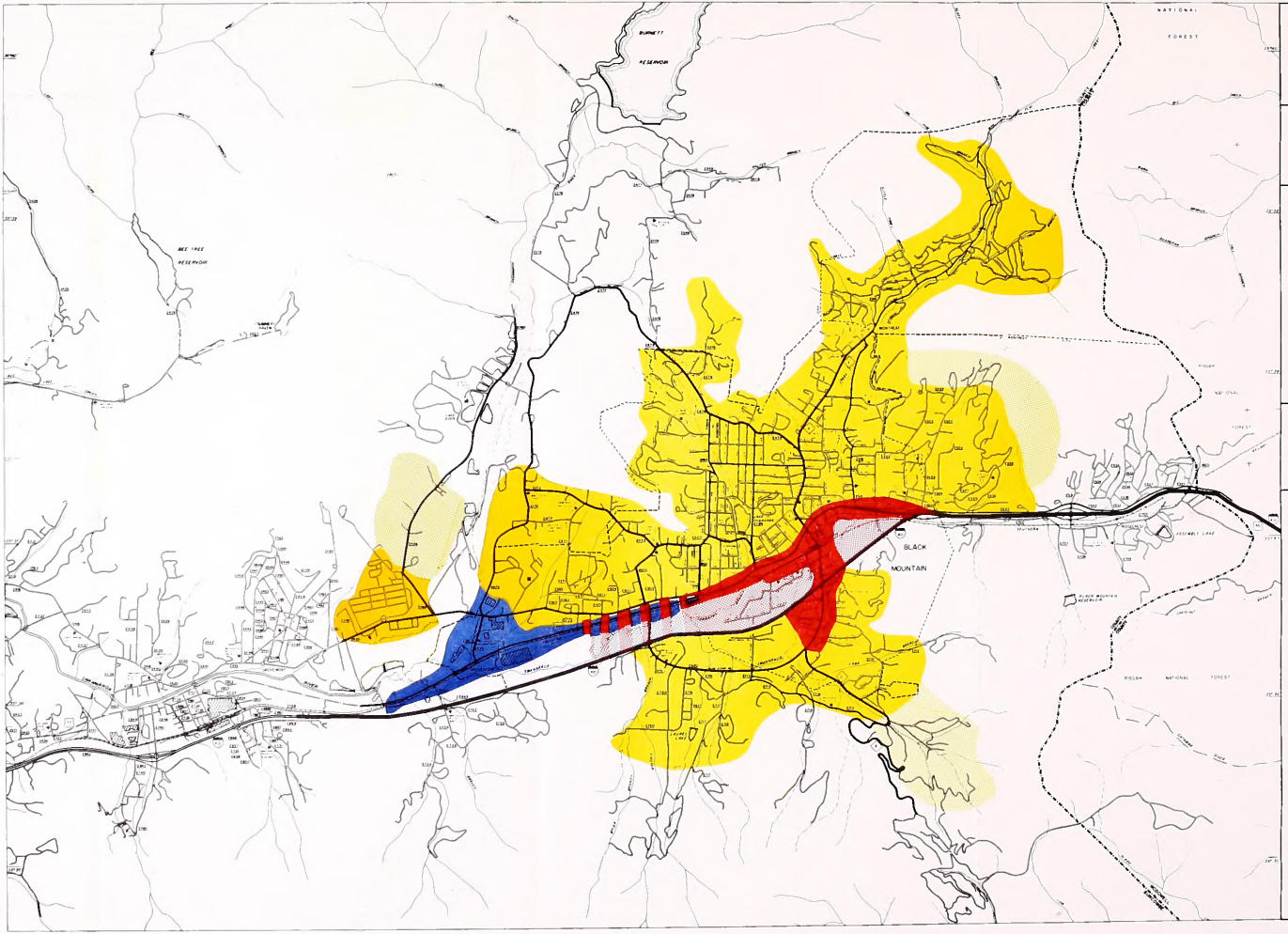
Land Use

The generation of traffic on a particular street is closely related to the manner in which adjacent land is used. Some types of land generate more traffic than others and the attraction between different land uses varies with the intensity and spacial separation of the uses. Therefore, in transportation planning, it becomes necessary to designate land uses by type so that an analysis of the distribution of existing land uses can serve as a basis for forecasting future land use needs and the resulting travel patterns.

Identifying existing land use was accomplished via field surveys of the two towns and the collection of socio-economic data. Figure 2 shows existing and projected land use. In the summer of 1989, an intensive field survey was conducted in Black Mountain and Montreat to collect socio-economic data. This data, in part, consists of the location of homes and businesses, business type and size, and the dates businesses were established. The homes and businesses were located by zones. Theses zones are shown in Figure 3. Appendix D contains data concerning the homes and businesses.

To project future land use, discussions were held with local land use planners, the town managers, and other town and county representatives to determine where water lines would be laid, annexations would occur, and new residential, institutional, commercial, and industrial developments were planned or being encouraged. This information indicated where future growth can be expected.

Both Black Mountain and Montreat are predominantly residential. In Black Mountain, light commercial development exists along the length of US 70. Black Mountain enjoys a small but thriving central business district. Three schools are located in eastern Black Mountain. The new Owen High School and Black Mountain College, now an art school, are on Lake Eden Road. The old Owen High School which is being converted to a middle school is on US 70. Highland Farms Health Care and Retirement Center, a large complex providing



ADOPTED BY:

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REVISIONS ADOPTED BY:

TOWN OF BLACK MTN.	TOWN OF MONTREAT	PLANNING ENV. BRCH.	N.C. DEPT. OF TRANSP.

EXISTING AND PROJECTED LAND USE

LEGEND

EXISTING LAND USE
- COMMERCIAL
- RESIDENTIAL
- INDUSTRIAL

PROJECTED LAND USE
- COMMERCIAL
- RESIDENTIAL
- INDUSTRIAL

LEGEND	EXIST.	PROP.
FREEWAYS		
MAJOR THOROUGHFARE		
MINOR THOROUGHFARE		

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BLACK MOUNTAIN AND MONTREAT THOROUGHFARE PLAN

MARCH 11, 1991

FIGURE 2

PREPARED BY THE
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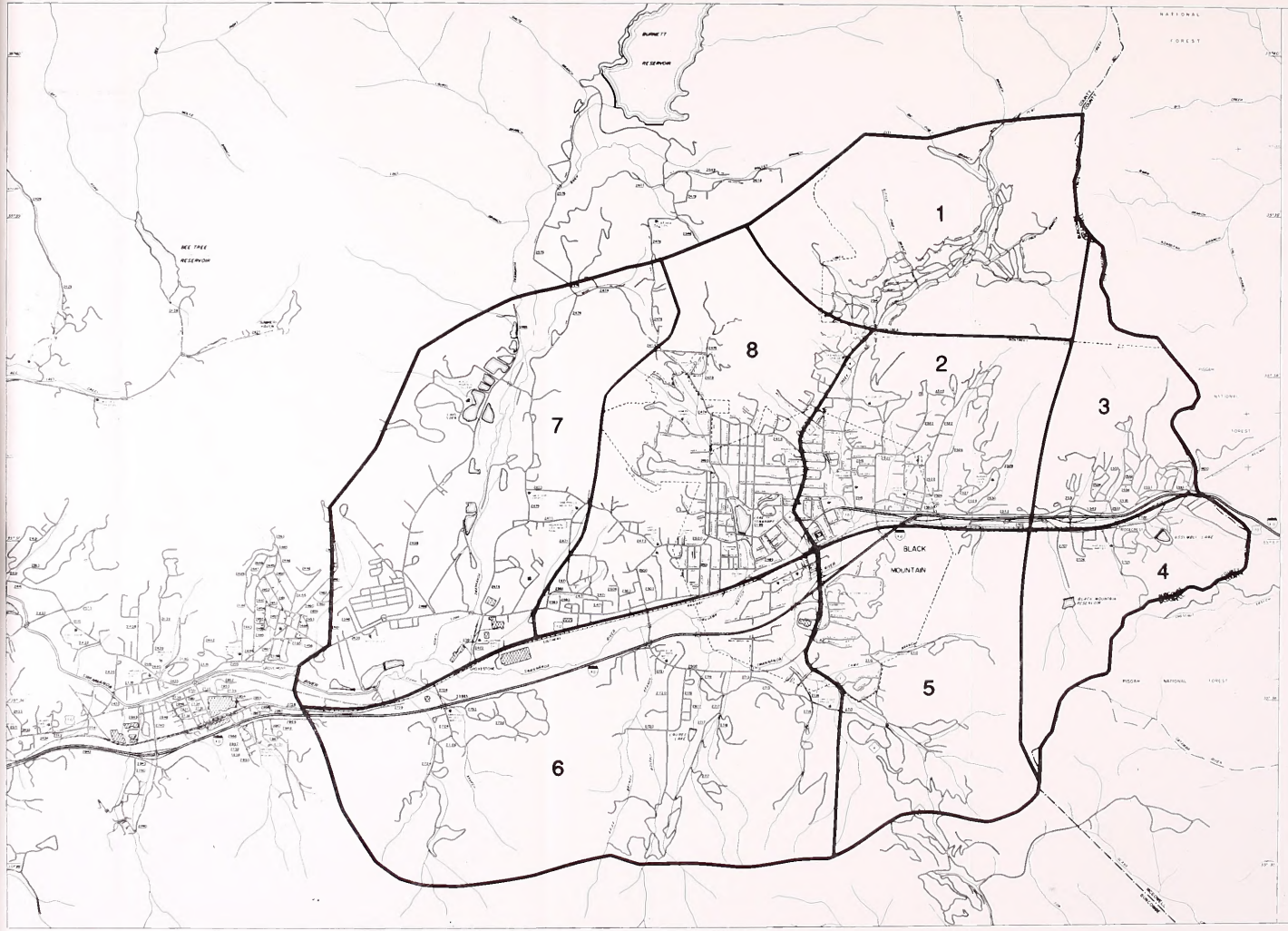
IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALE



PLANNING AREA AND ZONES

LEGEND

PLANNING AREA AND ZONE BOUNDARIES

#1 - 8 ZONE NUMBERS

BLACK MOUNTAIN AND MONTREAT

PLANNING AREA

FIGURE 3

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS - PLANNING AND RESEARCH BRANCH

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

AUGUST, 1986

homes and nursing care for the elderly is also located on US 70 on the eastern outskirts of Black Mountain. Approximately six industries are located in Black Mountain, most in the western section of town. Montreat has no commercial or industrial development. It is residential and parklike with summer and permanent residences, a conference center, and camps. It also supports a small college, Montreat-Anderson College.

Future growth in Black Mountain is expected to expand first towards the south, then towards the east, and finally to the west. It is anticipated that commercial development will fill in between existing development at US 70 and I-40, situated south of the central business district. Some industrial development may locate on Blue Ridge Road between US 70 and I-40. Other development, primarily residential but perhaps some commercial, is expected in the vicinity of the new high school on Lake Eden Road. Some residential development is planned for western Black Mountain. In Montreat, little expansion should occur if only twenty new properties are developed every ten years.

Travel Demand

Unlike larger urban areas such as Asheville, the travel demand for smaller towns such as Black Mountain and Montreat is not computer modeled since the model does not accurately represent smaller areas. However, the travel patterns between shopping, schools, housing, and employment areas are much simpler to discern in the smaller areas. Thus, experience has shown that it is more desirable to base travel demand on past traffic trends and expected future development in smaller areas such as Black Mountain and Montreat.

To predict future traffic volumes and patterns, existing and historical traffic must first be studied. Travel demand is generally reported in the form of average daily traffic counts. Traffic counts are taken regularly at several locations in and around Black Mountain and Montreat by NCDOT. For this report, counts taken from 1981 to 1990 were researched. Figure 4 shows existing traffic volumes.

On the larger roads, where frequent counts have been taken and steady growth has occurred, the MINITAB statistical analysis package was used to predict future traffic volumes. Given a series of traffic volumes and corresponding years, MINITAB uses least squares linear regression to derive an equation of the following form:

$$VOLUME = A + (B * YEAR)$$

where VOLUME = TRAFFIC VOLUME IN GIVEN FUTURE YEAR

A = CONSTANT

= average volume - (B * average year)

B = COEFFICIENT OF INDEPENDENT VARIABLE "YEAR"

$$= \frac{\Sigma(\text{year - ave. vol.})(\text{vol. - ave. vol.})}{\Sigma(\text{year - ave. year})^2}$$

YEAR = ANY FUTURE YEAR A.D. (e.g. 2020)

For example, the station on I-40 east of US 70 has the following equation:

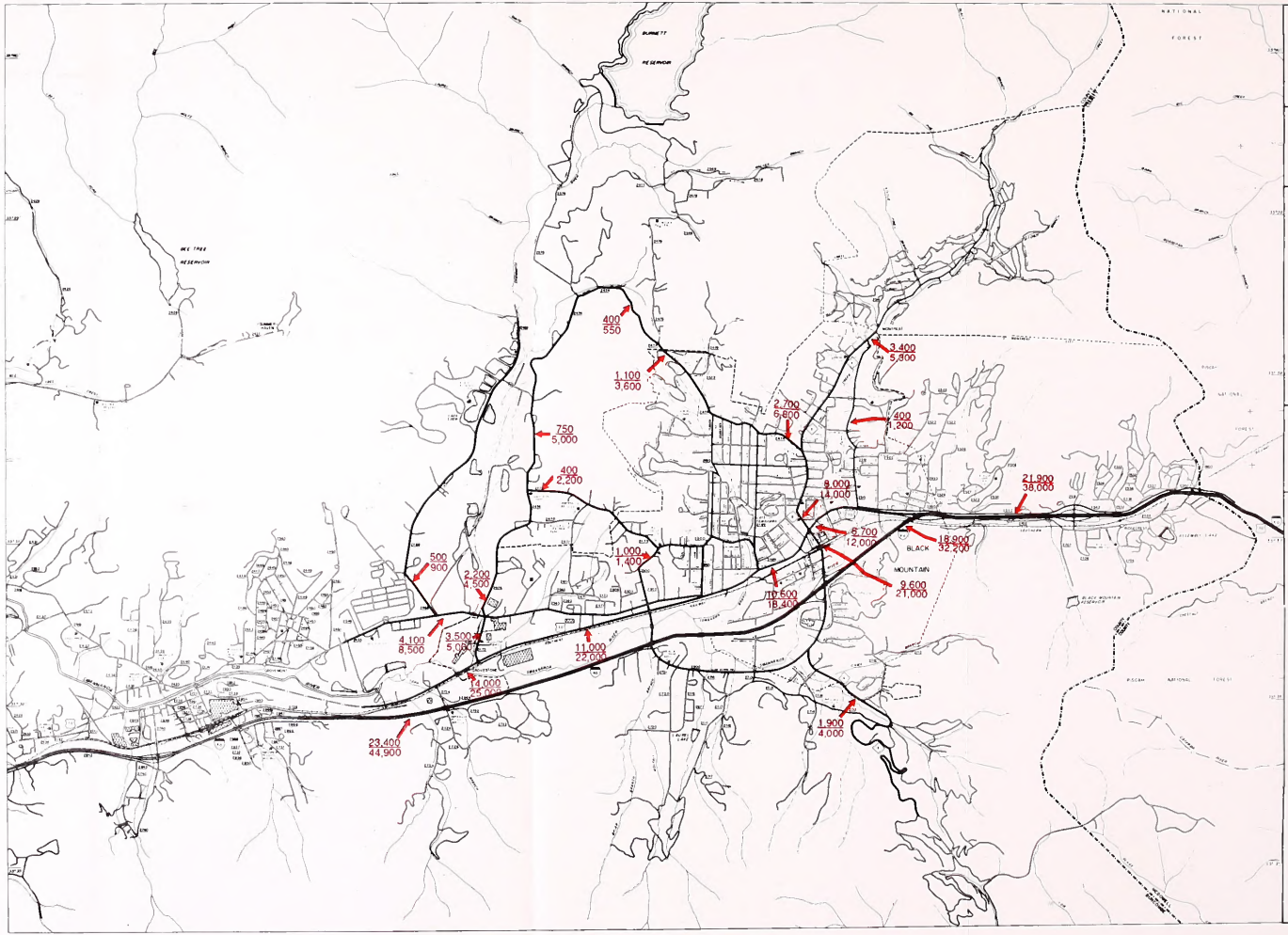
VOLUME = -1,006,314 + 517(YEAR)

Thus, for the year 2020 a volume of 38,000 is predicted on I-40 (-1,006,314 + 517*2020 = 38,000). MINITAB also calculates a R^2 value which indicates the accuracy of the equation. For the previous example, R^2 was 98.4%. Volumes on I-40, US 70, and NC 9 were calculated using this method. In addition, a percent growth per year was calculated to aid further in the prediction of future traffic. Where necessary, adjustments were made to account for unusually high growth rates caused by now complete development. As with any mathematical solution to a non-mathematical situation such as future development, adjustments to these calculations were made to reflect expected future development. Figure 4 shows traffic volumes predicted to occur in 2020.

For the smaller roads where less data was available or where growth was nominal, the R^2 correlation was too low to use this method. For these roads, the percent growth per year was calculated and then adjusted to account for any biases caused by past development or to reflect plans for new development. For example, traffic on North Fork Road near Old US 70 grew from 1,200 in 1981 to 2,200 in 1989 at a rate of 7.9%. This somewhat high rate reflects the development of the Highland Farms complex. Since this development is at least 90% complete, it is not expected that the traffic will continue to grow as quickly as in the past. Thus, a more reasonable growth rate of 2.3% was used. This rate will more than double the volume on the road to 4,500 in 2020.

Capacity Analysis

A major objective of the thoroughfare plan is to adequately plan for future deficiencies in the roadway system. Deficiencies usually occur when the amount of traffic on a road exceeds the capacity of the road. The capacity of a road is defined as the maximum number of vehicles that can safely and efficiently traverse the road



EXISTING AND FUTURE
TRAFFIC VOLUMES

LEGEND

00,000 = 1990 TRAFFIC VOLUME
00,000 = 2020 TRAFFIC VOLUME

BLACK MOUNTAIN
AND
MONTREAT
THOROUGHFARE PLAN
MARCH 11, 1991

FIGURE 4

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS - PLANNING AND RESEARCH BRANCH
IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

during a twenty-four hour period. Capacity is dependent on several factors. Under normal conditions, road width and alignment, the number of traffic signals and driveways, and the existence of parking influence capacity the most. When the capacity of a road is exceeded, congestion occurs. This leads to increased driving time, fuel consumption, air pollution, and traffic accidents. The thoroughfare plan recommends specific methods to avoid congestion and its by-products. Appendix B gives a more detailed explanation of capacity analysis.

Within the planning period (present to 2020), no streets within Montreat are expected to exceed capacity on an average daily basis. In Black Mountain, however, traffic volumes on a portion of US 70 and sections of NC 9 are anticipated to exceed the practical capacity of the roadway. Improvements on US 70 from Dougherty Street to NC 9 are recommended. This section is operating near capacity now. To avoid future congestion, parking on the north side of US 70 warrant removal within the next five years. Similarly, parking on both sides of NC 9 from State Street south to the railroad will warrant removal. It is recommended that this proposal be implemented within the next eight to ten years. Future traffic volumes on NC 9 from Seventh Street south to State Street are also expected to exceed capacity; therefore, a turn lane is proposed for this section. The additional third lane will allow vehicles to turn into adjacent streets and property without interupting the free flow of traffic in the through lanes. This improvement will be necessary near the end of the planning period.

Traffic Accidents

Since reducing traffic accidents is a major goal in any thoroughfare plan, accident reports for the Black Mountain-Montreat area for the three year period between April, 1988 and 1991 were studied. High accident locations are shown in the following table.

Table 2. High Accident Locations

LOCATION	NUMBER OF ACCIDENTS (APRIL 1988-1991)
I-40/US 70 junction	14
US 70/Blue Ridge Rd intersection	14
Blue Ridge Rd/Old US 70 (SR 2435) intersection	12
US 70/Old US 70 intersection	11

Since none of these accident problems could be solved by a long-range planning improvement, they were referred to the Division Traffic Engineer for study.

Additional Considerations

In addition to population, land use, traffic trends and accidents, a variety of other information was researched and integrated into the analysis of the Black Mountain-Montreat street system. The additional information included:

- Physical data concerning streets - road widths, speed limits
- Areas of historical, archaeological, cultural, and public significance
- Environmental resources/concerns - wetlands, scenic rivers, endangered species, hazardous wastes
- Topography

These areas are discussed in more detail as they pertain to the recommendations. Also, meetings with local officials, planners, and residents were held to discuss the Towns' concerns and goals as related to traffic and land use. These discussions proved integral to the analysis.

In conjunction with the citizen meetings concerning the recommended thoroughfare plan, discussions were held concerning the feasibility of encouraging bicycle use as an alternate mode of travel in Black Mountain and Montreat. These discussions were led by a member of the Asheville Urban Area Bicycle Task Force. This task force is composed of concerned citizens, area bicycle shop owners, and Land-of-Sky Regional Council (LOSRC) staff. The task force has been meeting for several years and is currently inventorying roads according to their safety and level of difficulty. This inventory is the basis for recommending bicycle routes and "bicycle-friendly" road improvements. Road improvements to facilitate bicycle use are recommended by the task force for consideration in the Priority Needs Statement and eventually in the Transportation Improvement Program (TIP). When the task force recommendations are complete and endorsed by both Towns and the Asheville Urban Area Transportation Advisory Committee (TAC) and Technical Coordinating Committee (TCC), they will be considered for inclusion in the thoroughfare plan recommendations where appropriate. Currently, neither Black Mountain nor Montreat have official bicycle routes, although a Black Mountain-Montreat Bicycle Route Plan has been recommended by the task force.

IV. RECOMMENDATIONS

The street systems of Black Mountain and Montreat were classified into three categories: freeways, major thoroughfares, and minor thoroughfares. Figure 5, a map of the Black Mountain-Montreat Thoroughfare Plan, identifies the Towns' streets accordingly. Roads within the planning area which were not classified in one of these categories are considered local access streets. Traffic volumes, adjoining land use, type of traffic, origin and destination of traffic, and physical characteristics of the street were considered when classifying the streets. A list identifying these streets by their functional classification follows. Where deficiencies exist or are predicted to exist, specific roadway improvements are also recommended. More detail on the physical and operational characteristics of each road is given in Appendix A.

These recommendations cannot be considered all-inclusive since unforeseen future traffic conditions may necessitate other improvements in order to insure safe and efficient operation of the street system. Routine maintenance is also expected. It should be emphasized that the recommended plan is based on anticipated growth as indicated by current trends. Prior to construction of specific projects, a more detailed study will be required to reconsider development trends and to determine specific locations and design requirements. Also, should development occur differently from what has been projected, the Towns can request that the thoroughfare plan be revised to reflect those changes.

Freeways

1. **I-40 from eastern to western planning area boundaries** - There is adequate capacity on I-40 to accommodate the expected traffic growth.

Major Thoroughfares

2. **US 70, East and West State Street** - Traffic volumes on US 70 immediately west of NC 9 are expected to exceed the highway's current capacity. By removing existing parking, the needed additional capacity can be gained. It is anticipated that the parking on the north side of State Street will warrant removal near the year 2020. Figure 6 shows the locations of recommended parking removal. It is recommended that Black Mountain begin to acquire off-street parking to replace the on-street parking.

3. **NC 9 (Montreat Road, Broadway) from southern planning area boundary to Assembly Drive (Gates of Montreat)**

   A. Although the traffic volumes on Montreat Road from Assembly Drive to Seventh Street are not expected to

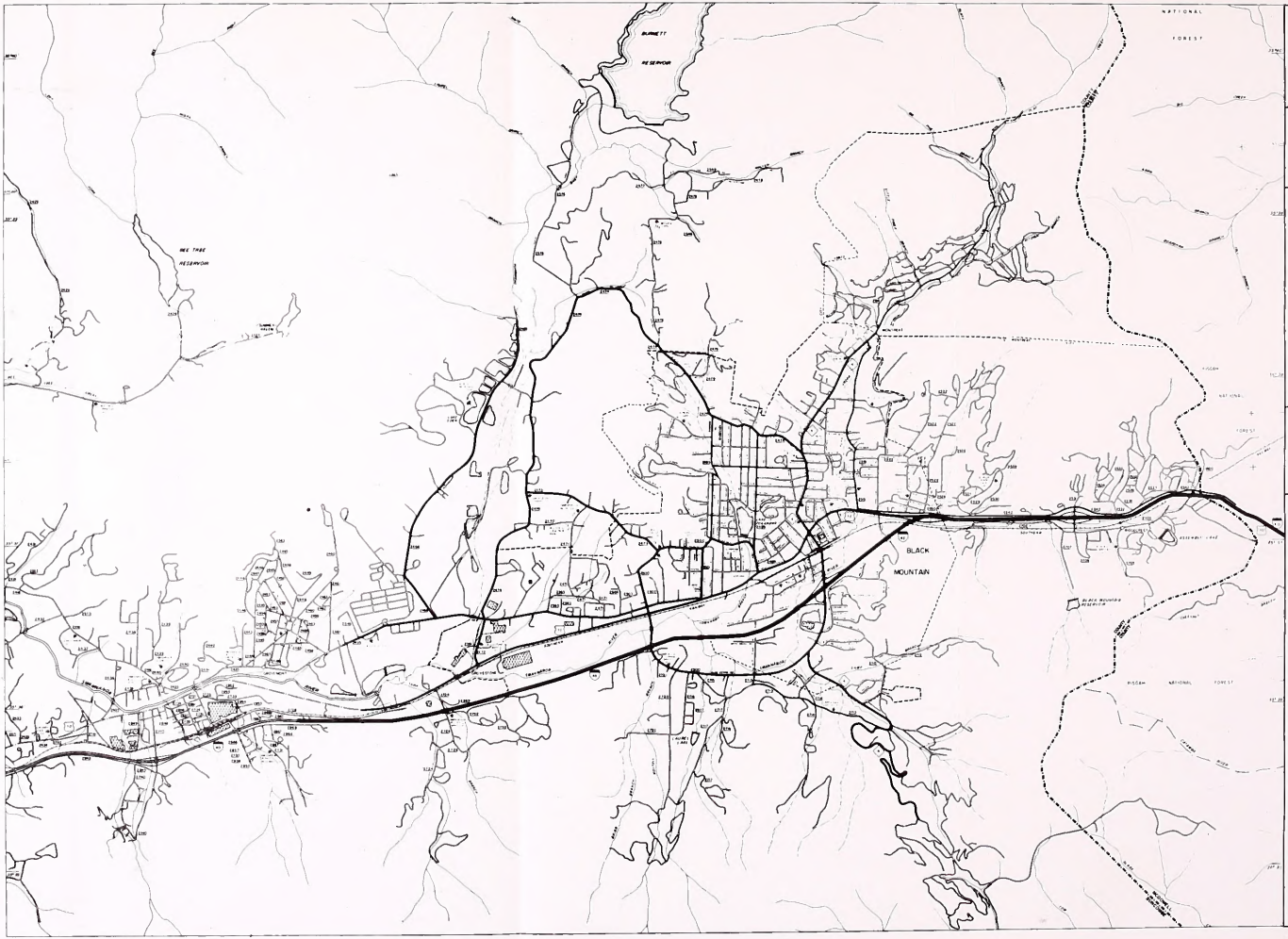
grow past capacity, improving it to a standard two-lane section with curb and gutter is recommended. Many pedestrians, the majority of which are children, use this road. Since no continuous shoulder or sidewalk exists, they are forced to walk in the road. In addition to creating a significant safety hazard for themselves and others, the pedestrians impede the traffic carrying ability of the road. Thus, improving the road to a standard two-lane section with curb-and-gutter is recommended. It is also strongly recommended that the Towns take this opportunity to construct a sidewalk. Although the construction of this project would require removing several decorative retaining walls that home owners have built, the merits of improved pedestrian safety outweigh this disruption.

B. Near 2020, the volume of traffic on NC 9 between Seventh Street and State Street is expected to warrant widening this two-lane section to three lanes. The additional lane will allow vehicles to turn into the adjacent side streets, churches, and homes without blocking the free flow of traffic in the through lanes. This project will also provide a good opportunity for the Town to construct sidewalks. No loss of homes or businesses will occur due to this project. Three lanes currently exist from State Street to First Street; however, they are not standard width. When this project is studied in the project planning phase, it will be determined if this section should be widened to a standard section.

C. In eight to ten years, parking on both sides of NC 9 from State Street to the railroad will warrant removal in order to accommodate expected future traffic volumes. Figure 6 shows the location of the proposed parking removal. Removing the parking will substantially increase the roadway available for traffic while further increasing the need for the Town to acquire off-street parking.

D. Concerned that emergency vehicles could be slowed by trains blocking downtown streets, the Towns suggested that an overpass crossing the railroad be built. Since traffic volumes do not warrant the cost of an overpass, this project is not recommended.

4. **Assembly Drive** - Since the number of attendees per conference in Montreat has peaked and the developer-set growth moratorium of twenty new houses in the next ten years is in place, traffic growth on Assembly Drive is expected to be slow. Thus, the existing road will be adequate to accommodate the expected traffic. If, however, growth occurs more rapidly, the thoroughfare plan may need to be revised.



ADOPTED BY:

PUBLIC HEARING — APRIL 15, 1991

TOWN OF BLACK MOUNTAIN — APRIL 15, 1991

TOWN OF MONTREAT — SEPT. 9, 1991

RECOMMENDED BY:
CHIEF ENGR. & DIV. ADMINISTRATOR, BRANCH — JULY 9, 1991

APPROVED BY:
DEPARTMENT OF TRANSPORTATION — AUGUST 6, 1991

REVISIONS ADOPTED BY:

TOWN OF BLACK MTN.	TOWN OF MONTREAT	PLANNING AND DEV.	N.C. DEPT. OF TRANSP.

LEGEND:

	EXIST.	PROP.
FREEWAYS		
MAJOR THOROUGHFARE		
MINOR THOROUGHFARE		

N

S

BLACK MOUNTAIN
AND
MONTREAT
THOROUGHFARE PLAN
MARCH 11, 1991

FIGURE 5

PREPARED BY THE
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS - PLANNING AND RESEARCH BRANCH
IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALE

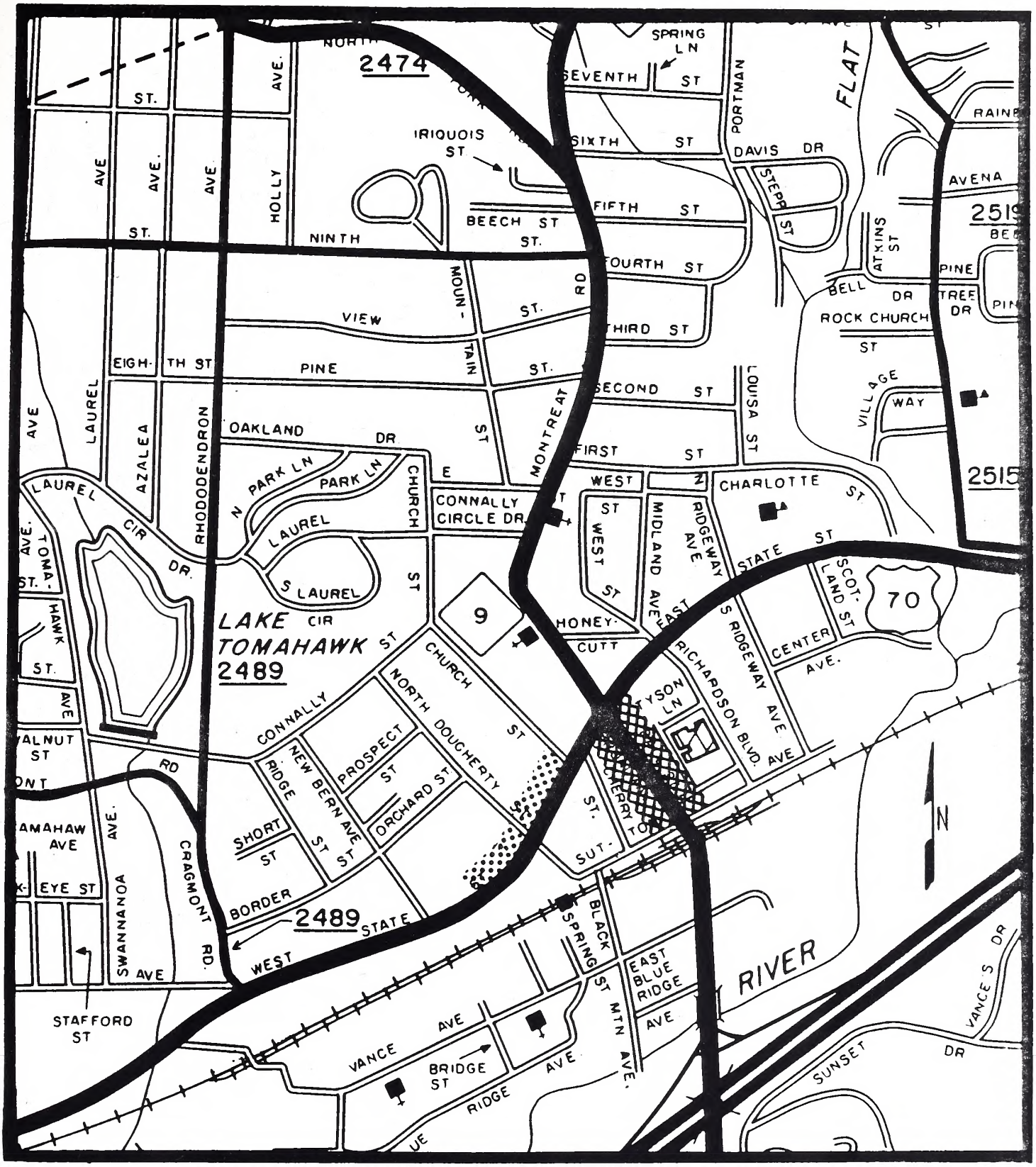


FIGURE 6 BLACK MOUNTAIN PARKING RECOMMENDATIONS

LEGEND

REMOVE PARKING IN 8-10 YEARS

REMOVE PARKING NEAR YEAR 2020

5. **North Fork Road/Tom Brown Road (SR 2474), Blue Ridge Road/Cragmont Road (SR 2500), Lake Eden Road (SR 2468, 2469), Old US 70 (SR 2435), and SR 2473** - There are no foreseeable capacity problems on these facilities; therefore, no improvements are recommended.

Minor Thoroughfares

6. **Hiawasse Avenue (SR 2495), Flat Creek Road (SR 2515), SR 2542, Rhododendron Avenue, Ninth Street, Vance Avenue, West College Street (SR 2501), SR 2713, and First Street/Charlotte Street** - Since there are no foreseeable capacity problems on these facilities, no improvements are recommended.

V. CONSTRUCTION IMPROVEMENTS AND COST ESTIMATES

The improvements suggested in the Black Mountain-Montreat Recommended Thoroughfare Plan obviously cannot be undertaken all at once, nor should they be. The cost would be overwhelming and the need for many of the improvements is not immediate. In an effort to reflect the relative value of various improvements, an assessment has been made of the benefits that can be expected from each project. These benefits can then be compared to the projected costs involved.

Three principal measures of benefits were used: road user cost savings, the potential for increased economic development resulting from the improvement, and the environmental impact, both positive or negative, which might result. The first measure is an actual estimate of dollar savings, while the others are estimates of the probability of the resulting change.

Reduced road user costs should result from any roadway improvement, from a simple widening to the construction of a new roadway to relieve congested or unsafe conditions. Comparisons of the existing and the proposed facility have been made in terms of vehicle operating costs, and accident costs. These user benefits are computed as total dollar savings over the 20 year design period using data such as project length, base year and design year traffic volumes, traffic speed, type of facility, and volume/capacity ratio.

The impact of a project on economic development potential is denoted as the probability that it will stimulate the economic development of an area by providing access to land with development potential and reducing transportation costs. It is a subjective estimate based on the knowledge of the proposed project, local development characteristics, and land development potential. The probability is rated on a scale from 0 (none) to 1.0 (excellent).

The environmental impact analysis considers the effect of a project on the physical, social/cultural, and economic environment. Many of these have been accounted for in evaluating the project with respect to user benefits, cost, and economic development potential. The environmental analysis evaluates the impact of the project on the following: (1) air quality, (2) water resources, (3) soils and geology, (4) wildlife, (5) vegetation, (6) neighborhoods, (7) noise, (8) educational facilities, (9) churches, (10) parks and recreational facilities, (11) historic sites and landmarks, and (12) public health and safety. The summation of both positive and negative impact probabilities with respect to these factors provides a measure of the relative environmental impact of a project. When recommending road

improvements, NCDOT attempts to avoid all negative environmental and social impacts. When such impacts cannot be avoided, NCDOT strives to minimize and mitigate them.

Offsetting the benefits that would be derived from any project is the cost of its construction. A new facility, despite its high projected benefits, might prove to be unjustified due to the excessive costs involved in construction. The highway costs estimated in this report are based on the average statewide construction costs for similar project types. An estimate of anticipated right-of-way costs is also included.

The following table lists proposed projects from the Recommended Thoroughfare Plan with respect to user benefits, estimated costs, probability of economic development, and environmental impact. The projects are listed according to net benefits (user benefits minus construction costs). When project planning studies are initiated, more detailed environmental studies will be conducted and more accurate cost estimates will be determined.

Table 3. Benefits Analysis of Proposed Projects

Project	Net Benefits	User Benefits	Project Costs	Economic Development	Enviro. Impact
	(in thousands of dollars)			(0 - 1.0)	(+/0/-)
US 70					
DOUGHERTY-NC9	4,990	5,010	20	0	+
NC 9 (C)					
STATE ST-RR	4,504	4,526	22	0.2	+
NC 9 (B)					
7TH ST-1ST ST	2,551	2,951	400	0.1	+
NC 9 (A)					
7TH ST-GATES	884	1,484	600	0	++

The widening of NC 9 from the Gates of Montreat to Seventh Street was proposed primarily as a safety measure rather than to increase capacity. The value given as "benefits" for this roadway is based on cost savings associated with reduced time traveled, vehicle operation and accidents on roads with similar traffic volumes and physical characteristics. It does not adequately reflect costs and benefits related to the unusually heavy pedestrian traffic on NC 9, and consequently has underrated the benefits which could be derived from this project. When prioritizing these projects or requesting funding, the Towns may want to classify this project as a safety improvement and consider it somewhat separately from

the other projects which are directed at increasing capacity.

Project comparison based on specified criteria can be used as a guide in implementing the recommended improvements. Construction priorities will vary depending on what criteria are considered and what weight is attached to the various criteria. Most people would agree that improvements to the major thoroughfare system and major traffic routes would be more important than minor thoroughfares where traffic volumes are lower. To be in the State's Transportation Improvement Program, a project must show favorable benefits relative to costs and should minimize disruption to the environment. Since conditions are constantly changing, the priorities should be reevaluated prior to construction.

An alternative to any of the proposed projects is the "do-nothing" option. According to the do-nothing concept, no improvements would be made to the existing streets and no new facilities would be constructed. Some major advantages of doing nothing include:

1. No capital investment cost.
2. No construction traffic disruption.
3. No noise, air, or water pollution due to construction.
4. No removal of shrubs or trees.
5. No additional land acquisition.
6. No displacement of homes or businesses as a result of construction.

There are, however, several disadvantages to a do-nothing policy which have significant adverse impacts on the community. These include:

1. Increasing traffic volumes and congestion on major streets which will cause traffic to divert to residential streets.
2. Existing "bottleneck" conditions will become worse.
3. Social, health, and safety standards will deteriorate.
4. Increased road user costs.
5. Increased driving time.
6. Increased accidents.
7. Increased air and noise pollution induced by traffic congestion.
8. Reduced mobility for emergency vehicles.
9. Increased transportation costs for businesses.
10. Reduced retail sales as a result of increased congestion, reduced accessibility, and higher transportation costs.
11. Increased driver and public frustration due to congestion.

The "do-nothing" option, while an alternative, is not viable

in light of the consequences identified above.

VI. ADOPTION AND IMPLEMENTATION

Once a thoroughfare plan is developed, it is presented to the town's governing body of officials and the public at a council meeting, Public Workshop, or some combination of the two. After these discussions and any necessary revisions, the plan is presented at a Public Hearing. The Public Hearing is an opportunity for the public to voice their opinions in an official manner before their governing officials vote on the adoption of the plan. These officials need only to adopt the thoroughfare plan map but may also adopt the accompanying report. Once the Town has adopted the thoroughfare plan, the Board Members of the North Carolina Department of Transportation normally adopt the plan. The thoroughfare plan then is a document stating that both the Town and NCDOT approve of the classification of the street system and recognize the need for the recommended improvements. This plan does not guarantee that these improvements will be built, but it can be used as a tool to gain support for including a specific improvement on the State's Transportation Improvement Program. Commonly referred to as "the T.I.P.", this document is a list of projects slated for funding by the NCDOT. More detailed information concerning the implementation of the thoroughfare plan is available in Appendix C: Administrative Controls and Implementation Tools.

This adoption process was followed accordingly in the development of the Black Mountain-Montreat Thoroughfare Plan. On March 11, 1991, a community workshop was held to present the thoroughfare plan and solicit public comment. On March 25, 1991, the plan was presented to the Black Mountain Planning Board. A public hearing was held on the recommended plan on April 23, 1991. The Asheville Urban Area Transportation Advisory Committee (TAC) endorsed the plan on May 8, 1991. The Towns of Black Mountain and Montreat adopted the thoroughfare plan on June 10, 1991 and May 9, 1991 respectively. The Statewide Planning Branch (previously part of the Planning and Environmental Branch) approved the thoroughfare plan on June 10, 1991. The Board of Transportation approved the plan on August 2, 1991.

Revision of the thoroughfare plan by NCDOT can be requested should either town experience some unforeseen growth. Normally, NCDOT will contact the Towns once a year to keep abreast of the their growth and the implementation of the thoroughfare plan. If necessary, the thoroughfare plan will be revised or entirely redone every five to ten years.

APPENDIX A

THOROUGHFARE CROSS SECTIONS

Typical cross sections recommended by the Thoroughfare Planning Unit are shown in Figure 7. Cross sections recommended for specific projects in Weaverville are identified in Table A-1.

Cross section "A" is illustrative for controlled access freeways. The 46 foot grassed median is the minimum median width. Wider variations could result depending upon design considerations. Slopes of 8:1 into 3 foot drainage ditches are desirable for traffic safety. Right-of-way requirements would typically vary upward from 250 feet depending upon cut and fill requirements.

Cross section "B" is typical for four lane divided highways in rural areas which may have only partial or no control of access. The minimum median width for this cross section is 30 feet, but a wider median is desirable. Design requirements for slopes and drainage would be similar to cross section "A", but there may be some variation from this depending upon right-of-way constraints.

Cross section "C", seven lane urban, and cross section "D", five lane urban, are typical for major thoroughfares where frequent left turns are anticipated as a result of abutting development or frequent street intersections.

Cross sections "E" and "F" are used on major thoroughfares where left turns and intersecting streets are not as frequent. Left turns would be restricted to a few selected intersections.

Cross section "G" is recommended for urban boulevards or parkways to enhance the urban environment and to improve the compatibility of major thoroughfares with residential areas. A minimum median width of 24 feet is recommended with 30 feet being desirable.

Typical cross section "H" is recommended for major thoroughfares where projected travel indicates a need for four travel lanes, but traffic is not excessively high, left turning movements are light, and right-of-way is restricted. An additional left turn lane probably would be required at major intersections.

Thoroughfares which are proposed to function as one-way traffic carriers would typically require cross section "I". Cross section "J" and "K" are usually recommended for minor thoroughfares since these facilities usually serve both land service and traffic service functions. Cross section "J" would be used on those minor thoroughfares where parking on both sides is needed as a result of more concentrated development.

Cross section "L" is used in rural areas or for staged construction of a wider multilane cross section. On some thoroughfares projected traffic volumes may indicate that two travel

lanes will adequately serve travel for a considerable period of time.

The curb and gutter cross sections all illustrate the sidewalk adjacent to the curb with a buffer or utility strip between the sidewalk and the minimum right-of-way line. This permits adequate setback for utility poles. If it is desired to move the sidewalk further away from the street to provide added separation for pedestrians or for aesthetic reasons, additional right-of-way must be provided to insure adequate setback for utility poles.

Rights-of-way shown for the typical cross sections are the minimum rights-of-way required to contain the street, sidewalks, utilities, and drainage facilities. Cut and fill requirements may require either additional right-of-way or construction easements. Obtaining construction easements is becoming the more common practice for urban thoroughfare construction.

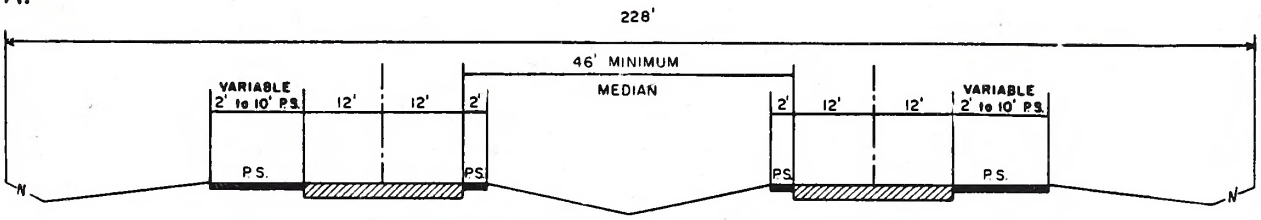
If there is sufficient bicycle traffic along the thoroughfare to justify a bicycle lane or bikeway, additional right-of-way may be required to allow for the bicycle facilities. The North Carolina Bicycle Facility and Program Handbook should be consulted for design standards for bicycle facilities.

Recommended typical cross sections for thoroughfares were derived on the basis of projected traffic, existing capacities, desirable levels of service and available right-of-way.

TYPICAL THOROUGHFARE CROSS SECTIONS

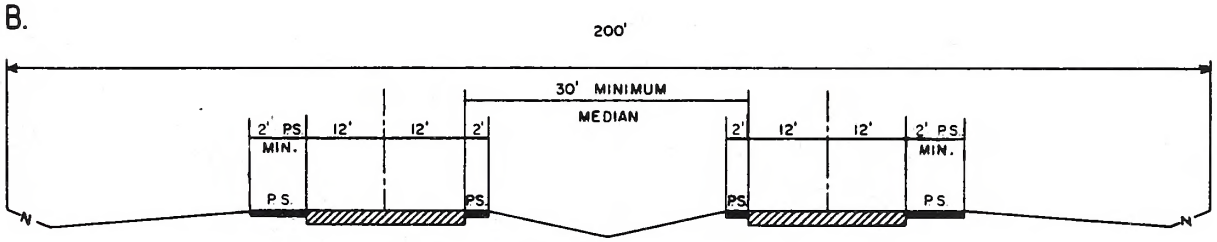
FIGURE 7

A.



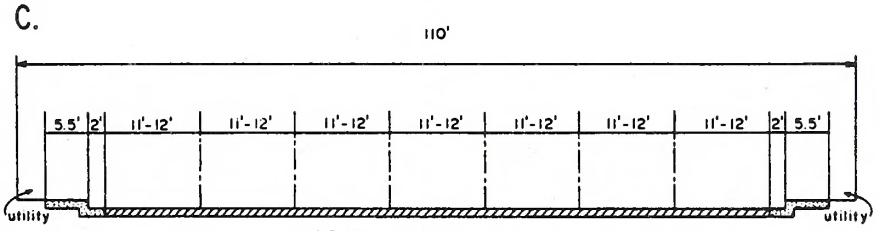
FOUR LANES DIVIDED WITH MEDIAN - FREEWAY

B.



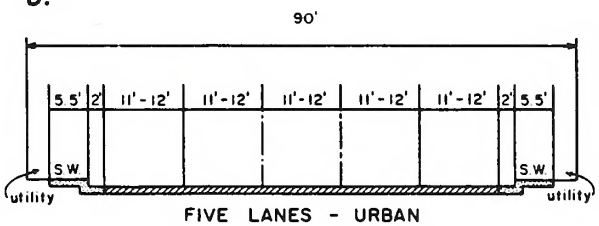
FOUR LANES DIVIDED WITH MEDIAN - RURAL

C.



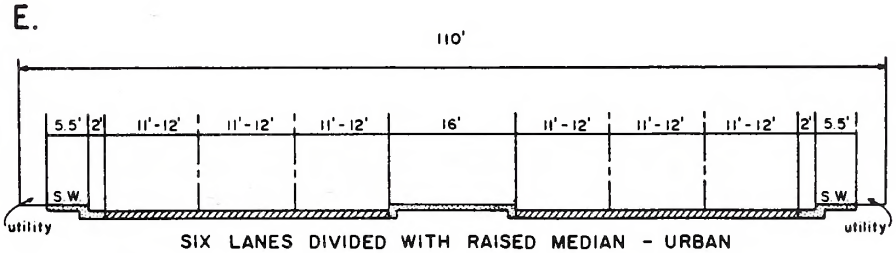
SEVEN LANES - URBAN

D.



FIVE LANES - URBAN

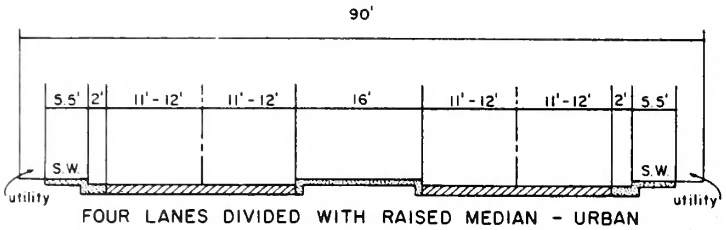
E.



SIX LANES DIVIDED WITH RAISED MEDIAN - URBAN

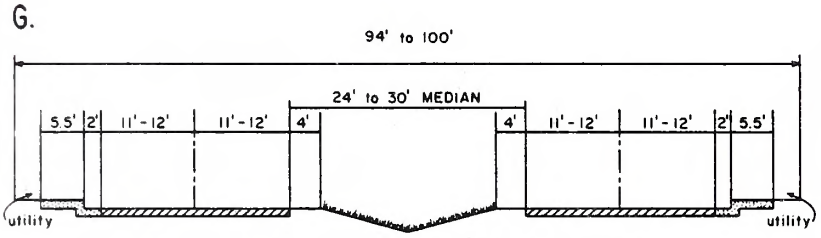
TYPICAL THOROUGHFARE CROSS SECTIONS
(CONTINUED)

F.



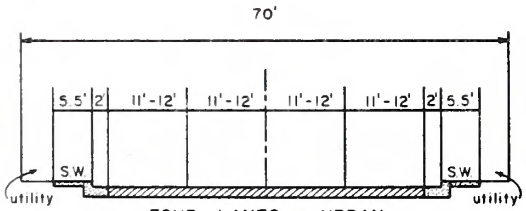
FOUR LANES DIVIDED WITH RAISED MEDIAN - URBAN

G.



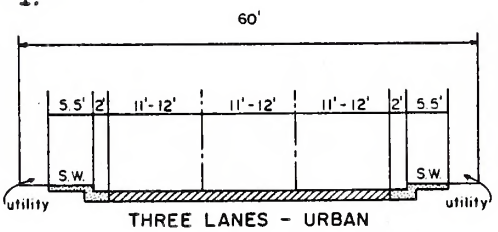
FOUR LANES DIVIDED - URBAN BOULEVARD
GRASS MEDIAN

H.



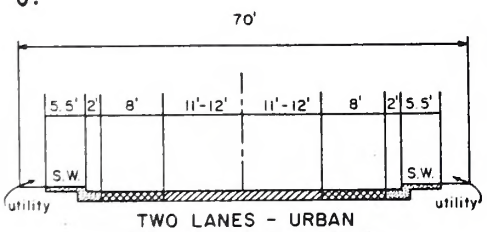
FOUR LANES - URBAN

I.



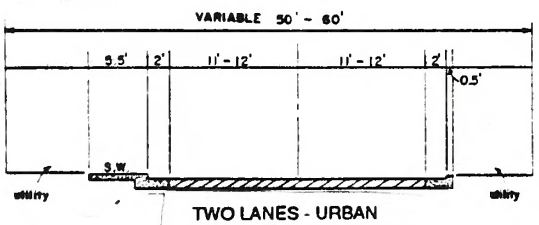
THREE LANES - URBAN

J.



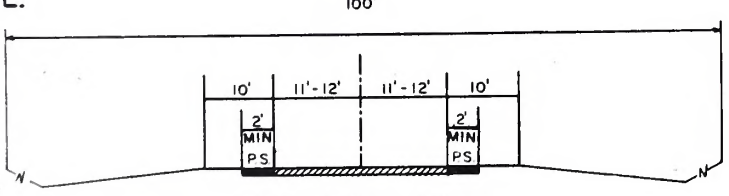
TWO LANES - URBAN
PARKING ON EACH SIDE

K.



TWO LANES - URBAN
SIDEWALK ON ONE SIDE

L.



TWO LANES - RURAL

TABLE A-1 THOROUGHFARE PLAN TABULATION AND RECOMMENDATIONS

LOCATION & SECTION	-EXISTING- LENGTH (MILES)	WIDTH (FT)	LANES	ROW (FT)	CAPACITY CURRENT (FUTURE)	1989 AADT	2020 AADT	-RECOMMENDED- RDWY (FT)	ROW/5 (FT)
I-40									
SR 2470 TO NC 9	5.1	2x24	4	350	54,000	23,400	45,000	ADQ	ADQ
NC 9 TO SR 2542	2.0	2x24	4	350	54,000	20,000	36,000	ADQ	ADQ
US 70 (W AND E STATE ST)									
SR 2441 TO WEST CITY LIMITS	3.8	64	5	100	40,000	12,000	23,000	ADQ	ADQ
W CITY LIMITS TO CRAGMONT RD	0.6	64	5	"	40,000	11,000	22,000	ADQ	ADQ
CRAGMONT RD TO DOUGHERTY ST	0.3	44	4	"	33,000	11,000	20,000	ADQ	ADQ
DOUGHERTY ST TO NC 9	0.2	44	3	"	11,000 (33,000)	10,600	18,000	/4	ADQ
NC 9 TO SCOTLAND ST (I-40)	0.3	36	3	"	14,000	6,700	12,000	ADQ	ADQ
NC 9 (MONTREAT RD, BROADWAY ST)									
PLAN AREA BDRY TO BLUE RIDGE RD	2.7	20	2	100	8,000	1,900	4,000	ADQ	ADQ
SUNSET DR TO SOUTHERN RR	0.6	52	4	120	40,000	12,000	26,000	ADQ	ADQ
SOUTHERN RR TO STATE ST	0.2	48	2	60	12,000 (35,000)	9,600	21,000	/4	ADQ
STATE ST TO FIRST ST	0.3	33	3	"	17,000	8,000	14,000	ADQ	ADQ
FIRST ST TO SEVENTH ST	0.5	23	2	"	11,000 (20,000)	7,000	12,000	40	I
SEVENTH ST TO MONTREAT ENT	1.0	19	2	"	7,500 (10,000)	3,400	5,500	28	K
ASSEMBLY DR									
MONTREAT ENTRANCE TO RD END	1.7	19	2	"	8,000	3,400	5,000	ADQ	ADQ
BLUE RIDGE RD (SR 2500)									
I-40 TO OLD US 70 (SR 2435)	1.8	19	2	80-100	8,500	2,700	5,500	ADQ	ADQ
OLD US 70 (SR 2435) TO SR 2473	0.5	16	2	NA	7,000	1,000	1,500	ADQ	ADQ
CRAGMONT RD (SR 2500, SR 2489)									
SR 2489 TO SR 2473	0.7	19	2	NA	7,000	2,700	5,500	ADQ	ADQ
US 70 TO SR 2500	0.2	17	2	60	8,000	1,000	1,800	ADQ	ADQ
FLAT CREEK RD									
NC 9 TO MT ZION CHURCH	0.4	22	2	NA	9,000	400	1,000	ADQ	ADQ
CHURCH TO FRONTAGE RD (SR 2542)	0.9	22	2	NA	9,000	700	2,000	ADQ	ADQ
FRONTAGE RD (SR 2542)									
FLAT CREEK TO RIDGECREST	2.1	24	2	60-80	12,000	3,100	5,500	ADQ	ADQ
RIDGECREST TO SR 1400	0.5	24	2	80	10,000	1,000	2,000	ADQ	ADQ
HIAWASSEE AVE (SR 2495)									
CRAGMONT RD TO N FORK RD	0.9	17	2	60	7,000	1,800	3,000	ADQ	ADQ
LAKE EDEN RD (SR 2468)									
OLD US 70 (SR 2435) TO OWEN HS	0.5	16	2	60	7,000	500	1,500	ADQ	ADQ
OWEN HIGH SCHOOL TO END	2.2	16	2	60	7,000	500	1,000	ADQ	ADQ
NINTH ST									
HIAWASSEE AVE TO NC 9	0.7	17	2	NA	7,000	NA	1,500	ADQ	ADQ

/1 WEST SIDE ONLY
/2 NORTH SIDE ONLY
/3 ULTIMATE ROADWAY WIDTH
/4 REMOVE PARKING
/5 SEE FIGURE 7
ADQ = ADEQUATE
NA = NOT AVAILABLE

TABLE A-1 THOROUGHFARE PLAN TABULATION AND RECOMMENDATIONS

LOCATION & SECTION	-EXISTING- LENGTH (MILES)	WIDTH (FT)	LANES	ROW (FT)	CAPACITY CURRENT (FUTURE)	1989 AADT	2020 AADT	-RECOMMENDED- RDWY (FT)	ROW/5 (FT)
NORTH FORK RD (SR 2474)									
SIXTH ST TO HIAWASSE AVE	0.8	20	2	NA	8,500	2,700	6,000	ADQ	ADQ
HIAWASSE AVE TO SR 2476	0.6	20	2	NA	8,500	800	3,000	ADQ	ADQ
OLD US 70 (SR 2435)									
OLD OWEN HIGH SCHOOL TO US 70	2.5	20	2	NA	9,000	4,100	8,000	ADQ	ADQ
RHODODENDRON AVE (SR 2489)									
CRAGMONT RD TO N FORK RD	0.8	17	2	60	8,000 (9,000)	1,000	1,800	ADQ	ADQ
SR 2472									
US 70 TO OLD US 70 (SR 2435)	0.4	24	2	60	11,000	3,500	5,000	ADQ	ADQ
SR 2473									
SR 2474 TO SR 2500	1.0	16	2	NA	7,000	400	2,000	ADQ	ADQ
SR 2713									
BLUE RIDGE RD TO NC 9	1.0	16	2	60	7,000	NA	1,200	ADQ	ADQ
TOM BROWN RD (SR 2474)									
SR 2476 TO SR 2473	2.2	20	2	NA	8,500	800	3,000	ADQ	ADQ
SR 2473 TO OLD US 70	1.0	19	2	NA	8,500	2,200	4,500	ADQ	ADQ

/1 WEST SIDE ONLY
/2 NORTH SIDE ONLY
/3 ULTIMATE ROADWAY WIDTH
/4 REMOVE PARKING
/5 SEE FIGURE 7

ADQ = ADEQUATE
NA = NA

APPENDIX B

CAPACITY ANALYSIS

Capacity is defined as the maximum number of vehicles that have a reasonable expectation of passing over a given section of roadway during a given period under prevailing roadway and traffic conditions.[1] The relationship of traffic volumes to the capacity of the roadway will determine the level of service being provided. Six levels of service have been defined to identify the conditions existing under various speed and volume conditions on a highway.

The six levels of service are illustrated in Figure 8, and they are defined on the following pages. The definitions are general and conceptual in nature, but they may be applied to all types of roads. The 1985 Highway Capacity Manual contains more detailed descriptions of the levels of service as defined for each facility type.

Level-of-service A represents free flow. Individual users are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to maneuver within the traffic provided to the motorist, passenger, or pedestrian is excellent.

Level-of-service B is in the range of stable flow, but the presence of other users in the traffic stream begins to be noticeable. Freedom to select desired speeds is relatively unaffected, but there is a slight decline in the freedom to maneuver within the traffic stream from level-of-service A. The level of comfort and convenience provided is somewhat less than at level-of-service A, because the presence of others in the traffic stream begins to affect individual behavior.

Level-of-service C is in the range of stable flow, but marks the beginning of the range of flow in which the operation of individual users becomes significantly affected by interaction with others in the traffic stream. The selection of speed is now affected by the presence of others, and maneuvering within the traffic stream requires substantial caution on the part of the user. The general level of comfort and convenience declines noticeable at this level.

Level-of-service D represent high-density, but stable flow. Speed and freedom to maneuver are severely restricted, and the driver or pedestrian experiences a generally poor level of comfort and convenience. Small increases in traffic flow will generally cause operational problems at this level.

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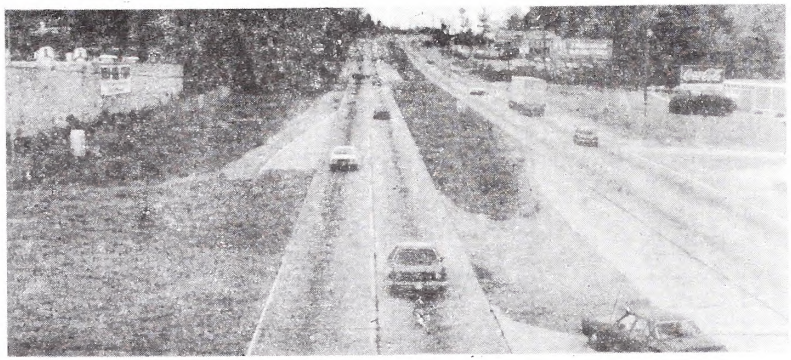
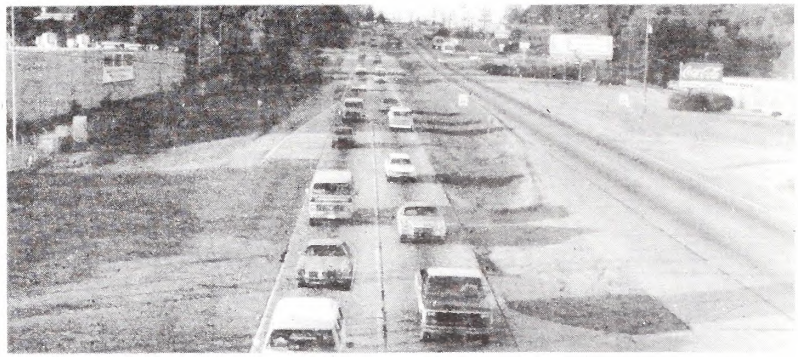
[1] Highway Capacity Manual, 1985

Level-of-service E represents operating conditions at or near the capacity level. All speeds are reduced to a low, but relatively uniform value. Freedom to maneuver within the traffic stream is extremely difficult, and it is generally accomplished by forcing a vehicle or pedestrian to "give way" to accommodate such maneuvers. Comfort and convenience levels are extremely poor, and driver or pedestrian frustration is generally high. Operations at this level are usually unstable, because small increases in flow or minor perturbations within the traffic stream will cause breakdowns.

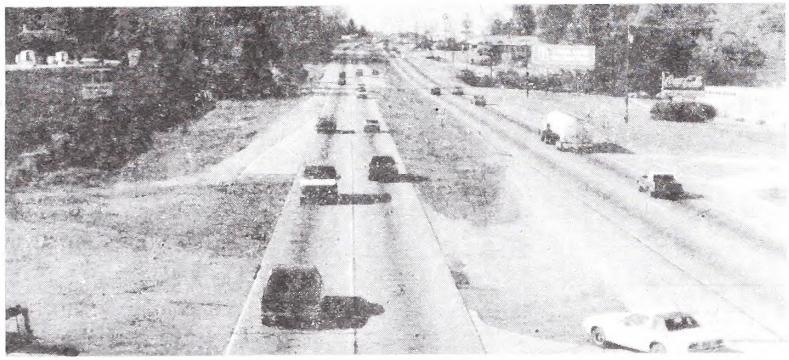
Level-of-service F is used to define forced or breakdown flow. This condition exists wherever the amount of traffic approaching a point exceeds the amount which can traverse the point. Lines form behind such locations. Operations within the line are characterized by stop-and-go waves, and they are extremely unstable. Vehicles may progress at reasonable speeds for several hundred feet or more, then be required to stop in a periodic fashion.



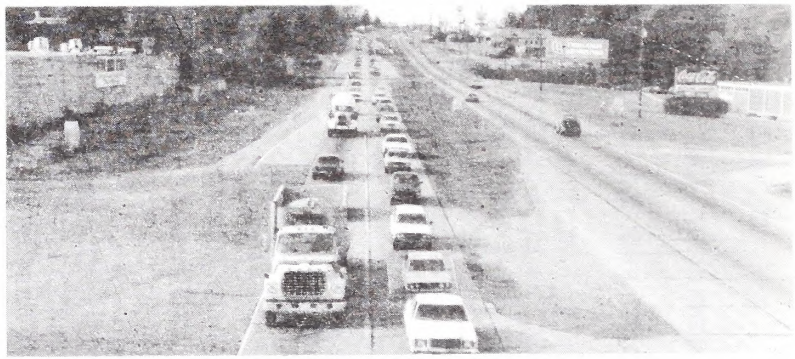
LEVEL OF SERVICE - A



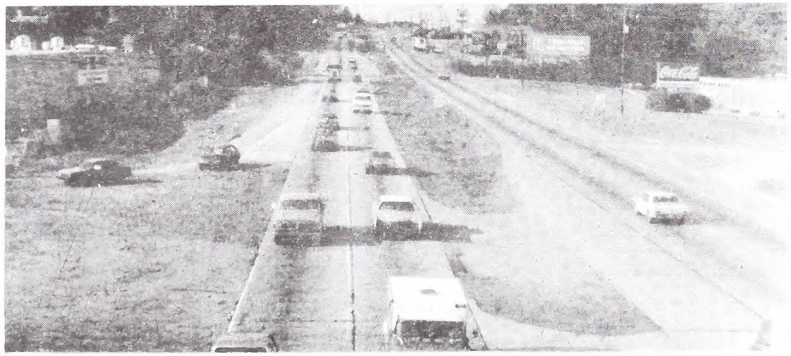
LEVEL OF SERVICE - D



LEVEL OF SERVICE - B



LEVEL OF SERVICE - E



LEVEL OF SERVICE - C

LEVEL OF SERVICE - F

LEVELS OF SERVICE

FIGURE 8

APPENDIX C

ADMINISTRATIVE CONTROLS AND IMPLEMENTATION TOOLS

State and Municipal Adoption of the Thoroughfare Plan

Chapter 136, Article 3A, Section 136-66.2 of the General Statutes of North Carolina provides that after development of a thoroughfare plan, the plan may be adopted by the governing body of the municipality and the Department of Transportation to serve as the basis for future street and highway improvements. The General Statutes also require that, as part of the plan, the governing body of the municipality and Department of Transportation shall reach agreement on responsibilities for existing and proposed streets and highways included in the plan. Facilities which are designated a State responsibility will be constructed and maintained by the Division of Highways. Facilities which are designated a municipal responsibility will be constructed and maintained by the municipality.

After mutual plan adoption, the Department of Transportation will initiate negotiations leading to determining which of the existing and proposed thoroughfares will be a Department responsibility and which will be a municipal responsibility. Chapter 136, Article 3A, Section 136-66.1 of the General Statutes provides guidance in the delineation of responsibilities. In summary, these statutes provide that the Department of Transportation shall be responsible for those facilities that serve volumes of through traffic and traffic from outside the area to major business, industrial, governmental, and institutional destinations located inside the municipality. The municipality is responsible for those facilities that serve primarily internal travel.

Unless implementation is an integral part of the transportation planning process, the effort and expense associated with developing a plan is lost. To neglect the implementation process is a three-fold loss -- the loss of the capital expenditures used in developing a plan, the opportunity cost of the capital expenditures, and more importantly the loss of the benefits that would accrue from an improved transportation system.

Administrative controls and implementation tools that can aid in the implementation process are generally available to municipalities through Federal and State Legislation. These controls and tools will be discussed in this chapter. They include: Subdivision Regulations, Zoning Ordinances, Official Maps, Urban Renewal, Capital Improvements Programs, and Development Reviews. Generally two issues play a major role in the implementation process - available finances and citizen involvement. Effective use of the controls and tools

listed above are indicative of good planning and minimize the effects of limited finances and negative citizen reaction to specific elements of a plan. It is through good planning that maximum use is made of every available dollar and that citizen involvement and approval of the transportation plan is obtained.

Available Controls and Tools

Subdivision Regulations

Subdivision regulations are locally adopted laws governing the process of converting raw land into building sites. From the planner's view, subdivision regulations are important at two distinct levels. First, they enable him to coordinate the otherwise unrelated plans of many individual developers. This process assures that provision is made for land development elements such as roadway right-of-way, parks, school sites, water lines and sewer outfalls, and so forth. Second, they enable him to control the internal design of each new subdivision so that its pattern of streets, lots, and other facilities will be safe, pleasant, and economical to maintain.

To be most effective, subdivision regulations and their administration must be closely coordinated with other local governmental policies and ordinances. Among the more important of these are the Comprehensive Growth Plan, Utilities Extension Master Plan, and Thoroughfare Plan.

In practice, subdivision regulations can provide some very positive benefits such as requiring portions of major streets to be constructed in accordance with the Thoroughfare Plan, or requiring subdividers to provide for the dedication and/or reservation of rights-of-way in advance of construction. These practices reduce the overall cost of the plan by having some costs borne by developers. Recommended Subdivision Ordinances are included in Appendix E.

Zoning Ordinances

Zoning is probably the single most commonly used legal device available for implementing a community's land-use plan. To paraphrase the U.S. Department of Commerce 1924 Standard Zoning Enabling Act, on which most present-day legislation is based, zoning may be defined as the division of a municipality (or other governmental unit) into districts, and the regulation within the districts of:

1. the height and bulk of buildings and other structures,
2. the area of a lot that may be occupied and the size of required open spaces,
3. the density of population, and

4. the use of buildings and land for trade, industry, residence, or other purposes.

The characteristic feature of the zoning ordinance that distinguishes it from most other regulations is that it differs from district to district, rather than being uniform throughout a city. Thus, a given area might be restricted to single-family residential development with minimum lot size requirements and setback provisions appropriate for development. In other areas, commercial or industrial development might be permitted, and regulations would be enacted to control such development. Building code provisions or sanitary regulations, on the other hand, normally apply to all buildings in a certain category regardless of where they may be situated within a city.

The zoning ordinance does not regulate the design of streets, utility installation, the reservation or dedication of parks, street rights-of-way, school sites, and related matters. These are controlled by subdivision regulations or possibly by use of an official map. The zoning ordinance should however, be carefully coordinated with these and other control devices.

Official Maps

The roadway corridor official map (or official map) is a document, adopted by the legislative body of the community, that pinpoints and preserves the location of proposed streets against encroachment. In effect, the official map serves notice on developers that the State or municipality intends to acquire certain specific property. The official map serves as a positive influence for sound development by reserving sites for public improvements in anticipation of actual need.

The NCDOT position is that it will limit the use of official maps to large scale, fully access controlled facilities planned for rapidly developing areas outside of municipal jurisdictions. For projects within municipal jurisdictions, official maps should be prepared and adopted by the local government. Municipalities may adopt official maps that extend beyond its extraterritorial jurisdiction with approval from the Board of County Commissioners.

It should be recognized that an official map places severe but temporary restrictions on private property rights. These restrictions are in the form of a prohibition, for up to three years, on the issuance of building permits or the approval of subdivisions on property lying within an official map alignment. The three year reservation period begins with the request for development approval. This authority should be used carefully and only in cases where less restrictive powers are found to be ineffective.

Requests for NCDOT to prepare and adopt an official map should be directed to the manager of the Program, Policy and Budget Branch. For cities contemplating the adoption of an official map, there are two ways in which the city may proceed. The first is to consider the official map statute as a stand-alone authority and use it as the basis for local adoption of an official map. Alternatively, the second approach is to adopt a local ordinance modeled after the statute, but modified to fit local circumstances and clarify the statute. Regardless of the approach taken, several procedural steps will need to be considered, such establishing procedures for consideration of variance petitions.

Once the project has been selected and the alignment determined, maps must be prepared that are suitable for filing with the County Register of Deeds Office. The map should show the proposed alignment in sufficient detail to identify the functional design and the preliminary right-of-way boundaries. Since the purpose of the map is to show the effect on properties along the project path, the existing property boundaries should be identified. As an additional requirement, within one year of the adoption of an official map, work must begin on an environmental impact study or preliminary engineering.

It is important to recognize the risks inherent in the adoption of an official map prior to completing the environmental studies. Projects to be funded using any federal funds require the unbiased evaluation of alternate alignments. This means that other alternatives will be studied and compared to the protected alignment.[1]

The above information is only to serve as an introduction to official maps, and in no way provides the information necessary to begin development of an official map. The Program and Policy Branch of the North Carolina Department of Transportation is responsible for facilitating the adoption of Official Street Maps. Cities considering Official Street Map projects should contact this Branch for their "Guidelines for Municipalities Considering Adoption of

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[1] "Guidelines for Municipalities Considering Adoption of Roadway Corridor Official Maps," prepared by NCDOT Program Development Branch

Roadway Corridor Official Maps" at:

Program Development Branch
NC Department of Transportation
P.O. Box 25201
Raleigh, North Carolina 27611

Urban Renewal

Urban renewal plays a minor role in the transportation planning implementation process in terms of scope and general influence. However, under the right circumstances, renewal programs can make significant contributions. Provisions of the New Housing Act of 1974 (as amended) call for the conservation of good areas, rehabilitation of declining areas, and clearance of slum areas. In the course of renewal, it is important to coordinate with the Thoroughfare Plan to see if additional set-back or dedication of right-of-way is needed.

Continued use of the urban renewal programs to improve the transportation system is encouraged. Changes that can be made under this program are generally not controversial or disruptive given the trauma of the clearance of a significant area.

Capital Improvement Programs

Capital programs are simply the coordination of planning and money. The capital improvements program, with respect to transportation, is a long range plan for the spending of money on street improvements, acquisition of rights-of-way and other improvements within the bounds of projected revenues. Municipal funds should be available for construction of street improvements which are a municipal responsibility, right-of-way cost sharing on facilities designated a Division of Highways responsibility and advance purchase of right-of-way where such action is warranted.

Historically, cities and towns have depended, to a great degree, on Federal or State funding to solve their transportation problems. Chapter 136-Article 3A of the Road and Highway Laws of North Carolina clearly outlines the responsibilities and obligations of the various governmental bodies regarding highway improvements. North Carolina Highway Bill 1211, passed in 1988, limits the role of municipalities in right-of-way cost sharing for projects once they are programed in the NCDOT Transportation Improvement Program. Set-back regulations, right-of-way dedications and reservations play a major role in the ultimate cost of many facilities. Only in special cases will the municipality be able to enjoy the benefits of highway improvements without

some form of investment.

Development Reviews

Driveway access to a State-maintained street or highway is reviewed by the District Engineer's office and by the Traffic Engineering Branch of the North Carolina Department of Transportation prior to access being allowed. Any development expected to generate large volumes of traffic (ie. shopping centers, fast food restaurants, large industries, etc.) may be comprehensively studied by staff from the Traffic Engineering, Planning and Environmental, and Roadway Design Branches of NCDOT. If done at an early stage, it is often possible to significantly improve the development's accessibility at minimal expense. Since the municipality is the first point of contact for developers, it is important that the municipality advise them of this review requirement and cooperate in the review process.

Other Funding Sources

1. Assess user impact fees to fund transportation projects. These fees, called "facility fees" in the legislation, are to be based upon "reasonable and uniform considerations of capital costs to be incurred by the town as a result of new construction. The facility fee must bear a direct relationship to additional or expanded public capital costs of the community service facilities to be rendered for the inhabitants, occupants of the new construction, or those associated with the development process."

2. Enact a bond issue to fund street improvements.

3. Continue to work with NCDOT to have local projects included in the Transportation Improvement Program (TIP).

4. Consider the possibility of specific projects qualifying for federal demonstration project funds.

5. Adopt a collector street plan that would assess buyer or property owners for street improvement.

6. Charge a special assessment for utilities. For example, water and sewer bills could be increased to cover the cost of street improvements.

APPENDIX D

EMPLOYMENT AND HOUSING INVENTORY

Information was collected by Land-of-Sky Regional Council in the summer of 1989. See Figure 3 for a map showing zones.

TABLE D-1 DWELLING UNITS BY ZONE

ZONE	DWELLING UNITS					
		CONDITION				
	TOTAL NUMBER	EXCELLENT	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	POOR
1	551	20	144	338	47	2
2	905	0	5	332	323	245
3	171	0	7	84	50	30
4	112	0	2	70	30	10
5	278	8	34	163	57	16
6	559	0	16	268	153	122
7	223	0	8	76	72	67
8	1665	0	45	649	628	343
TOTAL	4464	28	261	1980	1360	835

TABLE D-2 EMPLOYEES AND BUSINESS-RELATED CARS AND TRUCKS BY ZONE

ZONE	BUSINESSES				
	TOTAL NUMBER	FULL-TIME EMPLOYEES	PART-TIME EMPLOYEES	CARS	TRUCKS
1	11	182	48	19	13
2	53	336	161	17	44
3	4	88	71	44	11
4	5	11	31	2	1
5	7	23	35	3	1
6	33	272	229	16	14
7	15	1376	39	20	15
8	128	959	294	69	15
TOTAL	256	3247	908	190	144

TABLE D-3 BUSINESS TYPE BY ZONE

ZONE	NUMBER OF BUSINESSES				
	INDUSTRY	RETAIL AND WHOLESALE	HIGHWAY RETAIL	OFFICE	SERVICE
1	1	0	0	2	8
2	4	16	9	6	18
3	0	0	0	0	4
4	2	0	0	0	3
5	0	5	1	0	1
6	3	13	2	0	15
7	5	1	2	0	7
8	8	34	19	9	58
TOTAL	23	69	33	17	114

*** Data for Zones 1 and 7 is incomplete since the planning area boundary was extended in 1991 after socio-economic data was collected in the summer of 1989.

APPENDIX E

RECOMMENDED DEFINITIONS AND DESIGN STANDARDS

Definitions

I. Streets and Roads:

A. Rural Roads

1. Principal Arterial - A rural link in a highway system serving travel, and having characteristics indicative of substantial statewide or interstate travel and existing solely to serve traffic. This network would consist of interstate routes, intrastate routes, and other routes designated as principal arterials.

2. Minor Arterial - A rural roadway joining cities and larger towns and providing intrastate and intercounty service at relatively high overall travel speeds with minimum interference to through movement.

3. Major Collector - A road which serves major intracounty travel corridors and traffic generators and provides access to the arterial system.

4. Minor Collector - A road which provides service to small local communities and traffic generators and provides access to the major collector system.

5. Local Road - A road which serves primarily to provide access to adjacent land, over relatively short distances.

B. Urban Streets

1. Major Thoroughfares - Major thoroughfares consist of interstate, intrastate, other freeway, expressway, or parkway roads, and major streets that provide for the expeditious movement of high volumes of traffic within and through urban areas.

2. Minor Thoroughfares - Minor thoroughfares perform the function of collecting traffic from local access streets and carrying it to the major thoroughfare system. Minor thoroughfares may be used to supplement the major thoroughfare system by facilitating minor through traffic movements and may also serve abutting property.

3. Local Street - A local street is any street not on a higher order urban system and serves primarily to provide direct access to abutting land.

C. Specific Type Rural or Urban Streets

1. Freeway - Divided multilane roadways designed to carry large volumes of traffic at high speeds. A freeway provides for continuous flow of vehicles with no direct access to abutting property and with access to selected crossroads only by way of interchanges. (Design speed 70 mph, Operating speed 55 mph)

2. Secondary Freeway - A divided multilane roadway designed to carry moderate volumes of traffic at moderate speeds. The facility provides for the continuous flow of traffic through full control of access and the provision of interchanges or grade separation with no access at cross roads, and no traffic signals. (Design speed 50-55 mph, Operating speed 40-45 mph)

3. Parkway - A divided multilane roadway designed for noncommercial traffic, with full or partial control of access. Grade separations are provided at major intersections and there are no traffic signals.

4. Expressway - A divided multilane roadway designed to carry heavy volumes of traffic with full or partial control of access. Interchanges are provided at major intersections. There may be access to service roads and local streets, but there will be no signalized intersections.

5. Secondary Expressway - A divided multilane roadway designed to carry moderate volumes of traffic at moderate speeds. This facility may have partial control of access with right turn in and right turn out access to abutting property, and interchanges at major intersections. Some minor intersections may have traffic signal control.

6. Urban Arterial - Multilane roadway with signalized intersections, and access to abutting property. May have grass or barrier type median, or middle left turn lane.

7. Residential Collector Street - A local street which serves as a connector street between local residential streets and the thoroughfare system. Residential collector streets typically collect traffic from 100 to 400 dwelling units.

8. Local Residential Street - Cul-de-sacs, loop streets less than 2,500 feet in length, or streets less than one mile in length that do not connect thoroughfares, or serve major traffic generators, and do not collect traffic from more than 100 dwelling units.

9. Cul-de-sac - A short street having only one end open to traffic and the other end being permanently terminated and a vehicular turn-around provided.

10. Frontage Road - A road that is parallel to a partial or full access controlled facility and provides access to adjacent land.

11. Alley - A strip of land, owned publicly or privately, set aside primarily for vehicular service access to the back side of properties otherwise abutting on a street.

II. Property

A. Building Setback Line - A line parallel to the street in front of which no structure shall be built.

B. Easement - A grant by the property owner for use by the public, a corporation, or person(s), of a strip of land for a specific purpose.

C. Lot - A portion of a subdivision, or any other parcel of land, which is intended as a unit for transfer of ownership or for development or both. The word "lot" includes the words "plot" and "parcel".

III. Subdivision

A. Subdivider - Any person, firm, corporation or official agent thereof, who subdivides or develops any land deemed to be a subdivision.

B. Subdivision - All divisions of a tract or parcel of land into two or more lots, building sites, or other divisions for the purpose, immediate or future, of sale or building development and all divisions of land involving the dedication of a new street or change in existing streets; provided, however, that the following shall not be included within this definition nor subject to these regulations: (1) the combination of portions of previously platted lots where the total number of lots is not increased and the resultant lots are equal to or exceed the standards contained herein; (2) the division of land into parcels greater than ten acres where no street right-of-way dedication is involved; (3) widening or opening of streets; (4) the division of a tract in single ownership whose entire area is no greater than two acres into not more than three lots, where no street right of way dedication is involved and where the resultant lots are equal to or exceed the standards contained herein.

C. Dedication - A gift, by the owner, of his property to another party without any consideration being given for the transfer. The dedication is made by written instrument and is completed with an acceptance.

D. Reservation - Reservation of land does not involve any transfer of property rights. It constitutes an obligation to keep

property free from development for a stated period of time.

DESIGN STANDARDS

I. Streets and Roads

The design of all roads within the Town shall be in accordance with the accepted policies of the North Carolina Department of Transportation, Division of Highways, as taken or modified from the American Association of State Highway Officials' (AASHTO) manuals.

The provision of street rights-of-way shall conform and meet the recommendations of the Thoroughfare Plan, as adopted by the Town.

The proposed street layout shall be coordinated with the existing street system of the surrounding area. Normally the proposed streets should be the extension of existing streets if possible.

A. Right-of-way Widths - Right-of-way (ROW) widths shall not be less than the following and shall apply except in those cases where ROW requirements have been specifically set out in the Thoroughfare Plan.

	Minimum ROW
1. Rural	
a. Principal Arterial	
Freeways	350 ft.
Other	200 ft.
b. Minor Arterial	100 ft.
c. Major Collector	100 ft.
d. Minor Collector	80 ft.
e. Local Road	60 ft.[1]
2. Urban	
a. Major Thoroughfare other than Freeway and Expressway	90 ft.
b. Minor Thoroughfare	70 ft.
c. Local Street	60 ft.[1]
d. Cul-de-sac	Variable[2]

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[1] The desirable minimum right-of-way (ROW) is 60 ft. If curb and gutter is provided, 50 feet of ROW is adequate on local residential streets.

[2] The ROW dimension will depend on radius used for vehicular turn-around. Distance from edge of pavement of turn-around to ROW should not be less than distance from edge of pavement to ROW on street approaching turn-around.

The subdivider will only be required to dedicate a maximum of 100 feet of right-of-way. In cases where over 100 feet of right-of-way is desired, the subdivider will be required only to reserve the amount in excess of 100 feet. In all cases in which right-of-way is sought for a fully controlled access facility, the subdivider will only be required to make a reservation. It is strongly recommended that subdivisions provide access to properties from internal streets, and that direct property access to major thoroughfares, principal and minor arterials, and major collectors be avoided. Direct property access to minor thoroughfares is also undesirable.

A partial width right-of-way, not less than sixty feet in width may be dedicated when adjoining undeveloped property that is owned or controlled by the subdivider; provided that the width of a partial dedication be such as to permit the installation of such facilities as may be necessary to serve abutting lots. When the said adjoining property is subdivided, the remainder of the full required right-of-way shall be dedicated.

B. Street Widths - Widths for street and road classifications other than local streets shall be as recommended by the Thoroughfare Plan. Width of local roads and streets shall be as follows:

1. Local Residential
   Curb and Gutter section: 26 feet, face to face of curb
   Shoulder section: 20 feet to edge of pavement, 4 foot shoulders

2. Residential Collector
   Curb and Gutter section: 34 feet, face to face of curb
   Shoulder section: 20 feet to edge of pavement, 6 foot shoulders

C. Geometric Characteristics - The standards outlined below shall apply to all subdivision streets proposed for addition to the State Highway System or Municipal Street System. In cases where a subdivision is sought adjacent to a proposed thoroughfare corridor, the requirements of dedication and reservation discussed under Right-of-Way shall apply.

1. Design Speed - The design speed for a roadway should be a minimum of 5 mph greater than the posted speed limit. The design speeds for subdivision type streets are shown on the following page.

DESIGN SPEEDS			
Facility Type	Design Speed		
	Desirable	Minimum	
		Level	Rolling
Rural			
Minor Collector Roads	60	50	40
Local roads including Residential Collectors and Local Residential	50	50*	40*
Urban			
Major Thoroughfares other than Freeways, Expressways, or Parkways	60	50	50
Minor Thoroughfares	60	50	40
Local Streets	40	40**	30**

* Based on projected annual average daily traffic of 400-750 vehicles. In cases where road will serve a limited area and small number of dwelling units, minimum design speeds can be reduced further.
** Based on projected annual average daily traffic of 50-250 vehicles.

2. Maximum and Minimum Grades

   a. The maximum grades in percent shall be:

   b. Minimum grade should not be less than 0.5%.

   c. Grades for 100 feet each way from intersections (measured from edge of pavement) should not exceed 5%.

MAXIMUM VERTICAL GRADE		
Design Speed	Terrain	
	Level	Rolling
60	4	5
50	5	6
40	6	7
30		9

d. For streets and roads with projected annual average daily traffic less than 250, short grades less than 500 feet long, may be 50% greater than the value in the above table.

3. Minimum Sight Distance - In the interest of public safety, no less than the minimum applicable sight distance shall be provided. Vertical curves that connect each change in grade shall be provided and calculated using the following parameters. Sight distance provided for stopped vehicles at intersections should be in accordance with "A Policy on Geometric Design of Highways and Streets, 1984."

SIGHT DISTANCE				
Design Speed	30	40	50	60
Stopping Sight Distance				
Minimum (ft.)	200	275	400	525
Desirable Minimum (ft.)	200	325	475	650
Minimum K* Value for:				
Crest Curve	30	80	160	310
Sag Curve	40	70	110	160
* K is a coefficient by which the algebraic difference in grade may be multiplied to determine the length in feet of the vertical curve which will provide the desired sight distance.				
General practice calls for vertical curves to be multiples of 50 feet. Calculated lengths shall be rounded up in each case.				

4. The following "Superelevation Table" shows the maximum degree of curve and related maximum superelevation for design speeds. The maximum rate of roadway superelevation (e) for rural roads with no curb and gutter is 0.08. The maximum rate of superelevation for urban streets with curb and gutter is 0.06, with 0.04 being desirable.

SUPERELEVATION TABLE			
Design Speed	Maximum e*	Minimum Radius ft.	Max. Deg. of Curve
30	0.04	302	19° 00′
40	0.04	573	10° 00′
50	0.04	955	6° 00′
60	0.04	1,528	3° 45′
30	0.06	273	21° 00′
40	0.06	509	11° 15′
50	0.06	849	6° 45
60	0.06	1,380	4° 15′
30	0.08	252	22° 45′
40	0.08	468	12° 15′
50	0.08	764	7° 30′
60	0.08	1,206	4o 45′
e* = rate of roadway superelevation, foot per foot			

D. Intersections

1. Streets shall be laid out so as to intersect as nearly as possible at right angles, and no street should intersect any other street at an angle less than sixty-five (65) degrees. No street should intersect a railroad at grade at an angle less than sixty-five (65) degrees.

2. Property lines at intersections should be set so that the distance from the edge of pavement, of the street turnout, to the property line will be at least as great as the distance from the edge of pavement to the property line along the intersecting streets. This property line can be established as a radius or as a sight triangle. Greater offsets from the edge of pavement to the property lines will be required, if necessary, to provide sight distance for the stopped vehicle on the side street.

3. Offset intersections are to be avoided. Intersections which cannot be aligned should be separated by a minimum length of 200 feet between survey centerlines.

E. Cul-de-sacs

Cul-de-sacs shall not be more than five hundred (500) feet in length. The distance from the edge of pavement on the vehicular turn-around to the right-of-way line should not be

less than the distance from the edge of pavement to right-of-way line on the street approaching the turn-around. Cul-de-sacs should not be used to avoid connection with an existing street or to avoid the extension of an important street.

F. Alleys

1. Alleys shall be required to serve lots used for commercial and industrial purposes except that this requirement may be waived where other definite and assured provision is made for service access. Alleys shall not be provided in residential subdivisions unless necessitated by unusual circumstances.

2. The width of an alley shall be at least twenty (20) feet.

3. Dead-end alleys shall be avoided where possible, but if unavoidable, shall be provided with adequate turn-around facilities at the dead end as may be required by the Planning Board.

G. Permits For Connection To State Roads

An approved permit is required for connection to any existing state system road. This permit is required prior to any construction on the street or road. The application is available at the office of the District Engineer of the Division of Highways.

H. Offsets To Utility Poles

Poles for overhead utilities should be located clear of roadway shoulders, preferably a minimum of at least 30 feet from the edge of pavement. On streets with curb and gutter, utility poles shall be set back a minimum distance of 6 feet from the face of curb.

I. Wheelchair Ramps

All street curbs being constructed or reconstructed for maintenance purposes, traffic operations, repairs, correction of utilities, or altered for any reason, shall provide wheelchair ramps for the physically handicapped at intersections where both curb and gutter and sidewalks are provided and at other major points of pedestrian flow.

J. Horizontal Width on Bridge Deck

1. The clear roadway widths for new and reconstructed bridges serving 2 lane, 2 way traffic should be as follows:

   a. Shoulder section approach

      i. Under 800 ADT design year

         Minimum 28 feet width face to face of parapets of rails or pavement width plus 10 feet, whichever is greater.

      ii. 800 - 2000 ADT design year

         Minimum 34 feet width face to face of parapets of rails or pavement width plus 12 feet, whichever is greater.

      iii. Over 2000 ADT design year

         Minimum width of 40 feet, desirable width of 44 feet width face to face of parapets of rails.

   b. Curb and gutter approach

      i. Under 800 ADT design year

         Minimum 24 feet face to face of curbs.

      ii. Over 800 ADT design year

         Width of approach pavement measured face to face of curbs.

         Where curb and gutter sections are used on roadway approaches, curbs on bridges shall match the curbs on approaches in height, in width of face to face of curbs, and in crown drop. The distance from face of curb to face of parapet of rail shall be 1'6" minimum, or greater if sidewalks are required.

2. The clear roadway widths for new and reconstructed bridges having 4 or more lanes serving undivided two-way traffic should be as follows:

   a. Shoulder section approach - Width of approach pavement plus width of usable shoulders on the approach left and right. (Shoulder width 8' minimum, 10' desirable.)

   b. Curb and gutter approach - Width of approach pavement measured face to face of curbs.